



Faculty of Health, Science and Technology

Programme Study Plan

Master of Science in Energy and Environmental Engineering

Programme Code:	TACEM
Programme Title:	Master of Science in Energy and Environmental Engineering
ECTS Credits:	300 ECTS credits
Approval:	The Programme Study Plan was approved by the Faculty Board of Health, Science and Technology on 9 December 2016 and is valid from the autumn semester of 2017 at Karlstad University, Rev. 1 Dec. 2022.
Language of Instruction:	Swedish and English
Degree Level:	Master's
Degree Type:	Professional
Prerequisites	General admission requirements and Physics 2, Chemistry 1, Mathematics 4/Mathematics E

Introduction

The programme leads to a Master of Science Degree in Energy and Environmental Engineering. The aim of the programme is that students develop good knowledge and understanding of issues related to energy engineering and sustainable development. Central areas are environmental engineering, energy processes, fluid mechanics, and heat and mass transfer. Developing students' ability to analyse and understand relationships and to view problems from different perspectives is a central objective throughout the programme. A graduate in energy and environmental engineering from Karlstad University has up-to-date and specialised knowledge of installation, purification and bioenergy technologies, as well as the modelling and optimisation of energy systems. The broad and flexible qualifications are attractive to employers.

The need to switch from fossil-based energy systems to a more renewable energy requires experts with knowledge in the areas of energy and the environment, ability to think analytically and be prepared for innovation and change, qualities that are emphasised throughout the programme. There is a great need for adaptation in many sectors, nationally and internationally, which means that the labour market is broad and varied.

Systems analysis is a very useful tool to understand complex contexts. It can be used for understanding and optimising a physical process or analyse how available resources should be used in the best way to ensure that the objectives of changes are met. The change can be an external factor (e.g. laws, economy and materials) affecting the system or an inner factor (e.g. efficiency) describing the characteristics of the system. By analysing a change in advance, unpleasant surprises can be avoided, for example, financial costs or environmental impact.

As a method, systems analysis is used in connection with design, optimisation, investigation, or exploratory research and development. The application of systems analysis in programme courses ranges from pure calculation requiring deep subject knowledge to social analysis requiring broad knowledge.

The degree programme provides insights into the role of the master engineering graduate in social and economic development and makes students prepared for and committed to change, taking responsibility and showing respect. Students acquire knowledge and skills that are attractive nationally and internationally, and basic knowledge of natural science, technology and mathematics.

Aims

Upon completion of the programme, graduate engineers are prepared for doctoral studies in the field, have the ability to keep up with technological developments and have acquired a basis for lifelong learning.

For a Master of Science in Engineering, students should meet the requirements specified in the Higher Education Ordinance (SFS 2006:1053) as follows:

- Overarching aim: For a Master of Science in Engineering students should demonstrate the knowledge and skills required to work independently as a graduate engineer.

- Knowledge and understanding

For a Master of Science in Engineering students should

- demonstrate knowledge of the disciplinary foundation of and proven experience in their chosen field as well as insight into current research and development work, and
- demonstrate both broad knowledge of their chosen field, including knowledge of mathematics and the natural sciences, as well as a considerable degree of specialised knowledge in certain areas of the field.

- Competence and skills

For a Master of Science in Engineering students should

- demonstrate the ability to identify, formulate and deal with complex issues independently, critically, creatively and with a holistic approach and also to participate in research and development work and so contribute to the development of knowledge,
- demonstrate the ability to create, analyse and critically evaluate various technological solutions,
- demonstrate the ability to plan and use appropriate methods to undertake advanced tasks within predetermined parameters,
- demonstrate the ability to integrate knowledge critically and systematically as well as the ability to model, simulate, predict and evaluate sequences of events even with limited information,

- demonstrate the ability to develop and design 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 clearly present their conclusions and the knowledge and arguments on which they are based in speech and writing to different audiences in both national and international contexts.
- Judgement and approach
For a Master of Science in Engineering students should
 - demonstrate the ability to make assessments informed by relevant disciplinary, social and ethical aspects as well as awareness of ethical aspects of research and development work,
 - 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 both social and economic aspects and also environmental and occupational health and safety considerations, and
 - demonstrate the ability to identify a need for further knowledge and undertake ongoing development of their skills.
 - Independent project (degree project)
For a Master of Science in Engineering students should
 - as part of the programme complete an independent project (degree project) of at least 30 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 Master of Science in Energy and Environmental Engineering should also be able to:

- Knowledge and understanding
 - demonstrate specialised knowledge of systems analysis and its applications in energy and environmental engineering,
 - demonstrate specialised knowledge of the possibilities and limitations of social, economic, and ecological sustainability and demonstrate knowledge of sustainable engineering.
- Competence and skills
 - demonstrate ability to develop energy and resource efficient processes and systems in purification and installation engineering,
 - demonstrate ability to conduct systems analysis taking into account different space and time scales and the degree of details needed .
- Judgement and approach
 - demonstrate deepened insights into the possibilities and limitations of energy and environmental engineering, its role in society and our responsibility for how it is used, including social and economic aspects,
 - demonstrate ability to identify lack of knowledge in energy and environmental engineering and formulate alternative action in regard to this.

Programme Structure

The programme is divided into two levels: **Bachelor's level** (180 ECTS cr.) and **Master's level** (120 ECTS cr.). The first three semesters include mathematics, basic energy and environmental engineering and natural science. The advantage of this is that students acquire understanding of and insights into different aspects of possible fields of future professions.

Students have the opportunity to take elective courses throughout the course of study, preferably in consultation with the programme coordinator, as the choice of courses may affect later courses and degree requirements. Studying abroad is also an opportunity.

The **Bachelor's level** comprises six semesters and in addition to foundational courses in energy and environmental engineering includes courses in mathematics, technology and components of the fields of social science and the humanities. Students develop skills in project work, report writing and communication. These courses prepare students for Master-level studies, while they have the opportunity to earn a Bachelor's degree in energy and environmental engineering.

The **Master's level** comprises four semesters, 120 ECTS cr, of specialisation in energy and environmental engineering, at least 90 ECTS cr, including a degree project, 30 ECTS cr.

All students admitted to the programme are guaranteed places on the Master's level, provided that they meet the entry requirements for Master-level courses and the requirement for moving up from the third year (Bachelor's level) to the fourth year (Master's level), which is at least 120 credits completed in the years 1-3.

Students' learning process is considered in the choice of pedagogical methods and course content. Students learn to take responsibility for their own learning process. Instruction and close contact with both industry and research are important aspects of the programme. Authentic professional approaches such as projects are used in teaching and examination formats, and students develop writing skills through written exams and frequent report writing. They also develop oral skills through peer reviewing and continuous oral communication.

Gradual specialisation in the programme is ensured through the formulation of increasingly more complex learning outcomes that are assessed across the programme. Different forms of instruction, working methods and examination formats are used in the programme, ensuring scientific, methodological, content, language and professional specialisation and development. The links to research are designed to support the students' scientific and methodological progression.

The university's constant quality enhancement depends on enthusiastic lecturers offering quality courses. Student evaluations and student representation in preparatory and decision-making bodies play an important role in this respect.

Contact with the community is established early on in the programme and maintained throughout, with the aim of familiarising students with possible future employment areas and conditions and for cooperation in courses. During the last two years, course content is linked to research in progress at Karlstad University.

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

Bachelor's level: Energy and Environmental Engineering, including thermo and fluid mechanics, thermodynamics, systems analysis, installation and purification engineering, 97.5 ECTS cr, mathematics 37.5 ECTS cr, science and technology 30 ECTS cr and elective programme courses 15 ECTS cr. and elective courses 15 ECTS cr.

Master's level: Energy and Environmental Engineering, comprising, for example, energy and environment optimisation, sustainable engineering, research and development project, 90 ECTS cr, electives programme courses 15 ECTS cr and elective courses 15 ECTS cr.

Degree Title

Students who meet the requirements for a degree are entitled to receive a degree certificate from the University upon request to the Degree Office.

The degree title is:

Master of Science in Energy and Environmental Engineering, 300 ECTS credits

Credit Transfer

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

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