



HÖGSKOLAN I GÄVLE

Master Programme in Energy Systems 120 cr

Master Programme in Energy Systems 120 hp

Set by NT-board

Version

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Education level	Second cycle
Programme code	TAESM
Credits	120 cr
Diary number	2009-10-22

Programmespecific objectives

The education has a scientific basis and is based on the student's active responsibility for the studies. Strong emphasis is placed on active knowledge acquisition and personal development. After completed studies, the student should have advanced academic skills and be prepared for both continued third-cycle programmes and the working life.

Knowledge and Understanding

After the education, the student should:

demonstrate knowledge and understanding of the main field of energy systems, with an application in built indoor environments

demonstrate knowledge in order to carry out applications in industrial and building-technical energy systems, energy technical installations, building physics, heat transfer, advanced measurement and simulation techniques

demonstrate knowledge of environmental psychology, to be able to make adequate assessments of people's comfort, cognition and performance in built environments

demonstrate knowledge of indoor environments to be able to design technical systems for achieving a well-functioning indoor climate

demonstrate knowledge in energy systems to be able to carry out energy efficient solutions to create a sustainable development of society.

Skills and Abilities

After the education, the student should:

demonstrate the ability to creatively and independently analyse, understand and solve problems in indoor environments

demonstrate the ability to optimise energy systems regarding the use of energy and environmental resources

demonstrate the ability to critically, systematically and based on relevant information, evaluate and assess analyses in a scholarly way
demonstrate the ability to account for and discuss information, problems and solutions in dialogue, orally and in writing, with international groups, as the education recruits students from different parts of the world.

Judgement and Approach

After the education, the student should:

be able to make assessments in the main field of Energy Systems, applied in indoor environments, with consideration to relevant scientific, social and ethical aspects

demonstrate an understanding of the possibilities and limitations of technology, its role in society and people's responsibility for how it is used, by applying social, economic and environmental perspectives in the work

show an approach to knowledge and lifelong learning that is characterised by an active, responsible and self-reflecting way of studying, and the ability to identify the own need of additional knowledge and continuous development of skills

be able to understand and critically review advanced literature in the area of built environments, particularly in energy systems.

Target

A Degree of Master of Arts/Science (120 credits) is awarded after the student has completed the courses required to gain 120 credits with a defined specialisation determined by each higher education institution itself, of which at least 60 credits are for specialised study in the principal field (main field of study) of the study programme. In addition the prior award of a Degree of Bachelor's degree, Degree of Bachelor's degree in fine arts, professional or vocational qualification of at least 180 credits or a corresponding qualification from abroad is required.

The requirement of the prior award of a qualification may be waived for a student admitted to the programme without the basic entry requirement in the form of a qualification. This does not, however, apply if a waiver was granted during admission pursuant to the second paragraph of Section 28 of the Chapter 7 of the Higher Education Ordinance (1993:100) on the grounds that the qualification had not yet been issued.

Knowledge and understanding

For a Degree of Master of Arts/Science (120 credits) the student shall

demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work, and

demonstrate specialised methodological knowledge in the main field of study.

Skills and abilities

For a Degree of Master of Arts/Science (120 credits) the student shall

demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information

demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work

demonstrate the ability in speech and writing both nationally and internationally to report clearly and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and

demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Judgement and attitudes

For a Degree of Master of Arts/Science (120 credits) the student shall

demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work

demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and

demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Content and structure

In the programme, Energy Systems constitute the main field of study. The application of the main field of study mainly concerns industrial and building energy systems, but also global energy systems. The programme contains courses that intend to provide knowledge of these different energy systems so that the student is able to minimise resource utilisation and create a more sustainable society.

The first courses of the programme should provide the student with basic knowledge of indoor environments, the concept of energy systems and renewable energy. Also the production of energy from a thermodynamic and energy systems perspective is studied at the beginning of the programme. After the foundation has been laid, the use of energy and resources in society is studied, with focus on buildings and industrial usage.

The second year of the programme contains e.g. courses including simulation and optimisation of the energy systems covered earlier in the education. The optimisation is made with the purpose of minimising the resource use and the environmental impact (capital, raw material, manpower etc.), but still achieving the users' requirements on energy supply and indoor environment.

Courses in research methodology and advanced measurement techniques are included, which provide the skills required to participate in research and development. In addition, a course is given where the student will learn to understand how the energy market works in general, both for large and small-scale actors. The economic implications of different alternative measures that change the usage patterns should also be highlighted.

The programme ends with a degree project of at least 30 HE credits in the main field of energy systems. Through the degree project, the knowledge from previous courses should be applied, broadened and advanced. Through the degree project, the student should show that the aims for second-cycle programmes stated in the Higher Education Ordinance and the specific aims stated in this programme syllabus have been achieved.

General Arrangement

The programme is given as full-time studies, includes 120 HE credits and results in a master's degree in energy systems with a specialisation in built environments. The programme contains courses that provide knowledge of the application in built indoor environments, with the purpose of developing persistent methods for energy efficient system solutions for noise, ventilation, heating, refrigeration and climate.

The knowledge acquired in the programme courses will be applied in both inhabited environments (office premises, industrial premises etc.) and uninhabited environments (base stations, refrigeration of electronic components etc.)

The education ends with an independent degree project. The teaching is given in English.

Other degree

Independent project (degree project)

A requirement for the award of a Degree of Master of Arts/Science (120 credits) is completion by the student of an independent project (degree project) for at least 30 credits in the main field of study. The degree project may comprise less than 30 credits, however no less than 15 credits, if the student has already completed an independent project in the second cycle for at least 15 credits in the main field of study or the equivalent from a programme of study outside Sweden.

Degree title

Master of Arts/Science (120 Credits)

Prerequisites

A completed Bachelor's degree, corresponding to a Swedish Bachelor's degree (180 ECTS), or equivalent academic qualifications from an internationally recognised university.

The degree must be within the area of energy, mechanics, building or another adequate subject area. Also required is a minimum of 12 ects in Thermodynamics and Fluid mechanics.

English language proficiency equivalent to (the Swedish upper secondary school) English course B/6.

Other For students admitted to the later part of the programme and for students who have had approved leave from studies, a specific study plan is established by the faculty programme director in consultation with study advisers, when necessary.

Credit transfer of previous studies may be made, provided that the progression of the education is retained. The faculty programme director and subject representatives will determine if credit transfer is possible.

Year 1

Period	Identifier	Title	Level	Credits	Field
1:1	ETA002	<i>Energy Resources</i>	A1N	6 cr	Energy Systems
1:1	ETA000	<i>Energy Systems</i>	A1N	6 cr	Energy Systems
1:1	ETA001	<i>Heat and Power Generation</i>	A1N	6 cr	Energy Systems
1:2	ETA318	<i>Building Energy Systems</i>	A1F	6 cr	Energy Systems
1:2	ETA319	<i>Sustainable Cities</i>	A1F	6 cr	Energy Systems
1:3	ETA321	<i>Energy Systems Optimisation and Simulation</i>	A1F	6 cr	Energy Technology
1:3	ETA322	<i>Scientific Writing</i>	A1F	3 cr	Energy Technology
1:3	ETA320	<i>Industrial Energy Systems</i>	A1F	6 cr	Energy Systems
1:4	MX340D	<i>Environmental Assessment of Buildings</i>	A1N	7.5 cr	Energy Technology
1:4	MPA400	<i>Environmental Psychology</i>	A1F	7.5 cr	Environmental Psychology

Year 2

Period	Identifier	Title	Level	Credits	Field
2:1	ME549D	<i>Simulation and Optimisation for Building Environment</i>	A1F	7.5 cr	Energy Systems
2:1	ME556D	<i>Measurement Techniques for Building Energy and Indoor Climate</i>	A1F	7.5 cr	Energy Technology
2:2	ME555C	<i>Indoor Environment</i>	A1N	7.5 cr	Energy Systems
2:2	ETA324	<i>Applied Computational Fluid Dynamics</i>	A1F	7.5 cr	Energy Systems
2:4	ETA801	<i>Degree Project for a Master of Science with a Major in Energy Systems</i>	A2E	30 cr	Energy Systems