



**UNIVERSITY OF GÄVLE**

STUDY PLAN

ADVANCED LEVEL

MASTER PROGRAMME IN ENERGY SYSTEMS

Programme Code: TAENM

Approved by the NT-board 2008-11-27

**Study Plan**  
**Master Programme in Energy Systems,**  
**60 ECTS credits**

**This study plan applies to students registered autumn term 2009 or later**

# **MASTER PROGRAMME IN ENERGY SYSTEMS**

## **University of Gävle**

### **1 General organisation**

The master's degree programme in Energy Systems is made up of 60 ECTS credits and presupposes that the student has a degree of at least 180 ECTS credits in a relevant subject, e.g. energy, building, mechanics or equivalent. The programme is given entirely in English. The programme will have at least 15 ECTS credits of courses in cooperation with the master's degree programme in Building Environment Modelling – CFD, *Measurement techniques and Visualisation*.

The programme gives a basic knowledge in how the energy system functions. Energy Systems involves global/regional energy systems, the energy systems of buildings and industrial energy systems. In the programme simulation and optimising of these energy systems are put into practice with the purpose of creating lasting systems regarding energy, environment and economy.

### **2 Objectives**

#### **2.1 Objectives for higher education at advanced level according to the Higher Education Act, chap 1, § 9 and the examination description according to the Higher Education Ordinance appendix 2**

##### **2.1.1 Objectives for higher education at advanced level according to the Higher Education Act, chap 1, § 9**

Education at advanced level will essentially build on the proficiency which students gained within the education at basic level or equivalent attainment.

Education at advanced level shall involve a deepening of knowledge, skills and abilities in relation to the education at basic level and shall, in addition to that which applies for the education at basic level,

- further develop the students ability to independently integrate and use knowledge,
- develop the students ability to manage complex facts, problems and situations, and
- develop the students qualifications for a working life which places great demand on independence or for research and development work.

##### **2.1.2 Degree description according to the Higher Education Ordinance. appendix 2**

### **Master's Degree**

#### ***Extent***

The masters degree is obtained after the student has completed the course requirements of 60 ECTS credits with particular focus decided on by the individual college, with a minimum of 30 ECTS credits for specialisation

within the main field of study. A further demand is a completed bachelor's degree; artistic bachelor's degree, professional degree of a minimum 180 ECTS credits or equivalent foreign degree.

Exception from the demand of a previous degree can be given for a student who has been accepted for the programme without having a basic qualification in the form of a degree. This however does not apply if on acceptance an exception has been made according to chap 7 § 28 second paragraph because the degree certificate has not yet been issued.

### **Objectives**

#### *Achievement and understanding*

To gain a masters degree the student shall

- show achievement and understanding within the main field of study,
- including both a general view of the field of study as well as specialised attainment within certain sections of the subject along with an insight of current research and development work, and
- show advanced knowledge of method within the main field of study.

#### *Skill and ability*

To gain a masters degree the student shall

- show knowledge within energy technology in order to be able to carry through and understand technical solutions in energy technical installations
- show the ability to independently identify and formulate problems as well as plan and with adequate methods carry out qualified tasks within a given time
- show the ability to report clearly both orally and in writing and discuss their conclusions and the knowledge and arguments which form the basis for these in dialogue with different groups, and
- show the skills needed to take part in research and development work or to be able to work in another qualified activity.

#### *Assessment ability and attitude*

To gain a masters degree the student shall

- show the ability to make judgements within the main field of study with consideration to relevant scientific, social and ethical aspects as well as show awareness of ethical aspects in research and development work,
- show insight into the possibilities and limitations of science, its role in society and mankind's responsibility for how it is used, and
- show the ability to identify their need of further knowledge and to take responsibility for their own development of knowledge

### **Independent work (thesis)**

To gain a masters degree the student shall within the framework of the course requirements have completed an independent work (degree thesis) of a minimum of 15 ECTS credits within the main field of study.

## **Other**

For a masters degree with a particular direction the prescribed demands which each individual college has determined within the frame for the standards in this description shall also apply.

## **2.2 Particular objectives for the programme**

### *Achievement and understanding*

On completion of the programme the student shall

- show knowledge in the main field of study energy systems particularly so as to be able to carry out applications in thermo dynamics, lasting energy production, industrial and building technical energy systems, global and regional energy systems, optimising and simulation technology
- show knowledge in environmental psychology in order to be able to make adequate judgements of how mankind perceives the environment in a building environment
- show knowledge within energy technology in order to be able to carry through and understand technical solutions in energy technical installations.

### *Skill and ability*

On completion of the programme the student shall

- show understanding for the construction of the technical area energy systems in order to be able in a creative way to independently analyse, understand and solve problems with the help of optimising and simulation technology in global/regional building and industrial energy systems
- be able to evaluate and judge analysis in a scientific way
- be able to critically, systematically and with relevant information as a starting point report on the scientific project both orally and in writing

### *Assessment and attitude*

On completion of the programme the student shall

- be able to make judgements with consideration to relevant scientific, social and ethical aspects within the principal technical area energy systems
- show insight into the technology's possibilities and limitations, its role in society and mankind's responsibility for its use by constructing social, economic and environmental perspectives for their work
- show an attitude to knowledge and life-long learning which is characterised by an active, responsible and reflective method of study and the ability to identify the need for further knowledge and continued development of competence
- be able to profit by advanced literature within the main technology subject energy systems

### **3 Programme description**

#### **3.1 Main Field of Study**

##### **3.1.1 Energy Technology**

The main field of study Energy Technology and the application deals mainly with the three different energy systems, the Industrial energy system, the energy system of the building and Global energy systems. The students learn these three different energy systems and can use these in the work to minimise the use of resources.

The first course in the programme gives a basic knowledge in the concept of the energy system and on renewable energy. The production of energy from a thermo dynamic and energy system technology perspective is also studied at an early stage of the programme. After the foundation has been laid the use of energy in society starts to be studied and the area that is studied in more detail is building and industrial use. The final courses in the programme deal with simulating and optimising the energy systems which have been dealt with earlier in the education. Optimising is made with the aim of minimising the use of resources (capital, raw materials, work power, etc) but still fulfilling the expectations users put on energy provision. Besides this knowledge a course is also given where the students learn to understand how the energy market largely functions both for big and small scale operators. The economical implications for different alternative measures which change the pattern of use will also be illustrated.

The programme prepares for work within production, distribution and the use of energy as well as giving understanding for work with energy mostly at system level. A common feature of the entire programme is the creation of lasting energy systems, so that we economise with resources (i.e. work, capital, raw materials, energy and the environment) in the best possible way.

##### **3.1.2 Degree thesis**

The programme is completed with a degree thesis. Through the thesis knowledge from earlier courses shall be applied, broadened and deepened. Students shall show through the thesis that the objectives for a university education at advanced level as given in the Higher Education Act as well as the particular goals given in this study plan have been achieved. The thesis should be carried out individually or in pairs.

#### **3.2 Tuition and examination**

##### **3.2.1 Tuition**

The programmes courses are designed to give a comprehensive view and understanding so as to be able to design the optimal solution with regard to technology, environment and economy for an energy system. The pedagogical approach embraces conceptions like responsibility and freedom. This means that all teaching and tuition presupposes that students take their own responsibility and actively seek knowledge. Learning builds on an interactive process between the teacher and the student. Students have previously the experience of studying within natural science and technology which is an

important factor in the realisation of the courses. Progression within the main subject Energy Technology is given to begin with by studying courses of a basic character and afterwards continuing on to specialisation in the different parts within energy systems. Within the student group teams will be formed with a spread over different fields of competence in order to widen the academic discussion.. The courses in the programme will be given in English.

### **3.2.2 Examination**

Examination is done within the framework of the courses included in the programme. The form of the examination is chosen in such a way that the student is given the possibility to show their different proficiency and types of knowledge which are expressed by the expected results of learning. This means that a variety of different forms of examination will occur during the education, for example written and oral examinations as well as oral and written reports of tasks to be handed in and project work

### **3.3 Practical/work placement education**

No obligatory work experience is demanded. The thesis work can be located to any building industry applicable to any of the energy systems studied.

### **3.4 Student involvement**

There are student representatives in the university governing board, the faculty and research board and in the institutions governing body. Gefle Student Union elects the student representatives.

### **3.5 Internationalisation**

The programme will be given in English. The programme has cooperation and exchanges with several universities in Spain (e.g Barcelona, Valencia, Bilbao, Pamplona, San Sebastian and Navarra). Besides these we have cooperation and exchanges with universities in France and China.

### **3.6 Technology and Society**

An important starting point for the education is that a technically educated person must be able to look at new technology from a social perspective. The technically educated person needs knowledge of and skills in managing products, processes and the working environment with regard to mankind's requirements and needs and to society's aims concerning social conditions, the economisation of resources, environment and economy. On completion of the course the student should be able to take into account the human scientific and environmental demands when solving problems and developing products, and have the prerequisites to work towards an environmentally adapted technology. The working methods which develop these abilities are therefore central to the education. The entire programme is based on creating a lasting development in society by optimising the use of energy with reference to the different energy systems in society. This leads consequently to a diminished use of resources and therefore a lasting society.

#### 4 Courses within the programme

Students are guaranteed places to the courses in the programme. Application should be made for courses for the forthcoming term. Changes in the order of the courses can be made in discussion with those students active in the programme. Changes to the courses included in the programme are decided on by the faculty and research board. Changes to the period when a course is given is decided at institution level. An alternative choice of course can be made in discussion with the person responsible for the programme with the condition that the objective for the programme is achieved.

B = Basic level

A = Advanced level

Period	Course name	Credits	Level	Main Field of Study
1	Sustainable Energy Systems	7,5	B	Energy Systems
1	Heat and Power Generation	7,5	A	Energy Systems
2	Building Energy Systems	7,5	A	Energy Systems
2	Industrial Energy Systems	7,5	A	Energy Systems
3	Energy Systems – Simulation and Optimisation	7,5	A	Energy Systems
3	Energy and its Market	7,5	A	Energy Systems
4	Thesis project	15	A	Energy Systems

#### 5 Qualification

Those qualified to be accepted for the master's degree programme are those who have a degree at basic level consisting of a minimum of 180 ECTS credits, or equivalent foreign degree, with the focus on energy, mechanics, building or another adequate subject area. As well as these the student should have courses within fluid mechanics, thermo dynamics and heat transfer of 15 ECTS credits altogether or equivalent.

#### 6 Grades

Grades are set on the courses included in the programme according to the current syllabus

#### 7 Degree regulations

##### 7.1 Degree title

Degree of Master of Science (One Year) in Energy Technology.

##### 7.2 Degree criteria

In order to obtain a master's degree with main field of study in Energy Technology all the courses in the syllabus of 60 ECTS credits must be completed according to the programmes syllabus

### **7.3 Degree Certificate**

Students who fulfil the requirements for the degree shall on request receive a degree certificate. Every degree certificate will be accompanied by a degree supplement which describes the education and its position in the education system (Higher Education Ordinance chap 6 § 15) The supplement is called the Diploma Supplement. The Diploma Supplement will make acknowledgement easier and count as a Swedish degree on employment and for continued studies in Sweden or abroad.

### **8 Other regulations**

#### Transition stipulations

For students who have had an interruption of studies a special syllabus is created by the person responsible for the programme in consultation with the study advisor.