



## Programme syllabus

Faculty of Technology

Hållbara energitekniker och system, masterprogram, 120  
högskolepoäng

Sustainable Energy Technologies and Systems, master program, 120  
credits

### **Level**

Second Level

### **Date of Ratification**

Approved by Faculty of Technology 2022-09-09

The programme syllabus is valid from autumn semester 2023

### **Prerequisites**

General entry requirements for second level studies and specific entry requirements:

- Bachelor of Science in Chemical Engineering, Mechanical Engineering, Energy Technology, Environmental Technology, Civil Engineering, Material Science or the equivalent.
- English 6 or the equivalent.

### **Description of Programme**

The program provides studies in sustainable energy supply, energy conversion, energy efficiency and energy systems, as well as the associated environmental and societal implications. It will provide knowledge about different technologies for production and use of electric power, fuels and heat, and their roles in a sustainable development. The program aims to advance the competence and applied knowledge among students who have completed a bachelor's degree in technology, engineering or natural science.

The program prepares for a career as energy analyst, project coordinator, environmental controller or consultant, in the private and public sectors.

### **Objectives**

*Central degree goals according to the Higher Education Ordinance*

*Knowledge and understanding*

For a Degree of Master (two years) students shall:

- demonstrate knowledge and understanding of their main field of study, including

both general knowledge of the field and substantially deepened knowledge of certain parts of the field, along with an advanced insight into current research and development work; and

- demonstrate advanced methodological knowledge of their main field of study.

### *Skills and abilities*

For a Degree of Master (two years) students shall:

- demonstrate an ability to critically and systematically integrate knowledge and to analyse, assess and handle complex phenomena, issues and situations, even when limited information is available,
- demonstrate an ability to critically, independently and creatively identify and formulate questions; to plan and – using appropriate methods – perform qualified tasks within specified time limits, thus contributing to knowledge development; and to evaluate this work,
- demonstrate an ability to clearly present and discuss their conclusions and the knowledge and arguments upon which they are based, in dialogue with different groups, in speech and in writing, in national and international contexts, and
- demonstrate skills required to participate in research and development work or to work independently in other qualified contexts.

### *Judgement and approach*

For a Degree of Master (two years) students shall:

- demonstrate an ability to make assessments in their main field of study, taking relevant scientific, social and ethical aspects into account, and demonstrate an awareness of ethical aspects of research and development work,
- demonstrate insight into the potential and limitations of science, its role in society and people's responsibility for how it is used, and
- demonstrate an ability to identify their need of further knowledge and to take responsibility for their knowledge development.

## **Content**

### *Program overview*

The first semester treats aspects of the global energy system such as energy sources, sustainable energy technologies, environmental assessment, climate change, innovation and sociotechnical change. The second semester focus on environmental legislation and in-depth knowledge of bioenergy technologies and waste as a resource. The second part of the semester comprises a project course that provides the training to plan and execute a major project. The third semester includes a course focusing on solar and wind power technology and electric grid integration. It also includes 22,5 credits of elective courses. Suggested elective courses are Evaluation and Design of Energy Policies”, “Life cycle analysis” and “Energy management in the Built Environment”. Other courses may be chosen in consultation with the program coordinator. The fourth semester is the degree project (thesis) course.

### *Courses in the program*

#### **Year 1:**

Sustainable Energy Supply \* (7.5 credits, G1N)

This course gives an overview of the global energy system with focus on technologies that uses sustainable energy sources such as solar, wind and biomass. The course also gives basic knowledge in applied thermodynamics and training in calculation of energy conversion.

Diffusion of Innovations for a Sustainable Built Environment (7.5 credits, A1N)

This course deals with different theories on the spread of innovations and their applications. It treats the process through which innovations are developed, disseminated and implemented in society.

Environmental Analysis Methods \* (7.5 credits, A1N)

The course treats paradigms and tools to support environmental decisions. That includes industrial ecologic concepts, life cycle assessment, carbon footprint analysis, and water footprint analysis.

Scientific Theories and Methods \* (7.5 credits, A1N)

This course deals with academic writing complying with international standards for scientific publication. It also presents and discusses relevant scientific issues within the field of technology.

Laws of Sustainable Development and Energy (7.5 credits, A1N)

This course covers basic regulatory principles regarding environment, trade and commerce, as well as the related human rights at international, regional, and national levels.

Bioenergy and Waste as Resource (7.5 credits, A1N)

This course treats the use of biomass and waste resources for production of heat, electric power and biofuels. It covers different conversion technologies as well as economic societal and environmental aspects.

Project Work and Methodology (15 credits, A1N)

This course provides knowledge and training in planning of a major investment in the sustainable energy sector. It provides knowledge in how technology, economics and marketing work together; and how to estimate investment and operating costs.

**Year 2:**

Wind and Solar Energy (7.5 credits G1F)

This course focus on the practice of wind and solar power systems as well as grid integration. It also covers technical, economic and environmental aspects of large-scale energy storage.

Elective courses (in total 22.5 credits GIF).

The following courses are recommended:

- Evaluation and Design of Energy Policies (7.5 credits G1F) This course deals with how energy policies can be designed and implemented. It treats policy design, stakeholders, decision-making processes and policy instruments.
- Life Cycle Analysis (LCA) (7.5 credits A1N) This course deals with LCA of different products and service systems, taking into account the use of raw material and the environmental impact throughout the life cycle chain.

- Energy management in the built environment (7.5 credits G1F) This course treats the evaluation of urban energy supply and demand. It covers analysis of processes and techniques to meet energy needs, as well as the corresponding environmental and climate impact.

#### Degree Project \* (30 credits A2E)

The aim of this course is for the student to independently carry out a project, and to produce and present a thesis. This work includes defining a problem, conducting investigations and critically analyze the results in light of previous knowledge.

\* Courses in the main area.

The courses in the program may change order.

#### *Social relevance*

The entire program works on current issues about energy and climate and various solutions for sustainable social development. This means that students are faced with socially relevant problems (within e.g. industry, municipalities, regions, NGOs) and must formulate their proposals for solutions for these representatives. A number of companies have chosen to support the development of the program and will be involved in the program's courses in various parts, such as guest lectures, project assignments and degree projects. In this way, the students are prepared for a future professional role and potential employers meet the students during the education.

#### *Internationalization*

The students who wish to perform a part of the education abroad can do so during the third semester, alternative courses at another university may then be chosen in consultation with the program manager. Alternatively, the student can choose to complete his or her independent work in the fourth semester abroad.

#### *Perspective in education*

The program will lead to an ability to work effectively in companies with product, energy and sustainability issues, but also in the long run be equipped for opportunities to take leadership and managerial positions in multinational and national companies, public organizations, and NGOs (non-governmental organizations ) within the focus areas of the program. Sustainable development and gender: Education in the field of sustainable energy processes and systems is based on a sustainability perspective where class perspective, gender perspective, global resource management and international perspectives are consistent themes in most courses. The diversity perspective is automatically included as part of the courses offered on the international market, in that we have participants from different countries and groups. In the teaching, the students meet, give and learn different perspectives from each other's backgrounds, which is an integral part of the program. The different international perspectives enrich the examples in teaching that are based on global goals. Equal conditions are provided, e.g. through conscious group division strategies.

### Quality Development

The courses in the program are evaluated after each course and the results are processed by the teacher team in consultation to improve until the next course start. The program is linked to a program council including representatives from industry, representatives for the subject and the student group. Quality aspects of the education (program evaluation) and results from the course evaluations will be discussed in this council.

### Degree Certificate

After completing their studies in accordance with the requirements stated in the Higher Education Ordinance and in Linnaeus University's local Degree Ordinance, the student may apply for a degree. Students who have completed the program may obtain the

following degree:

A student holding a Technology Bachelor's degree alt. Bachelor of Science in Engineering can receive:

Master of Science (120 credits) with specialization in Sustainable Energy Technologies and Systems. Main field of study: Bioenergy Technology.

A student who holds another qualifying degree can receive:

Master of Science (120 credits) with specialization in Sustainable Energy Technologies and Systems. Main field of study: Bioenergy Technology.

The degree certificate is issued in two languages (Swedish and English). A Diploma Supplement in English is enclosed with the degree certificate.

### **Other Information**

The program comprises study visits, excursions, study tours and other similar mandatory element that may entail a cost for the student. Furthermore it is assumed that the student have the digital equipment required for the completion of the course.