



## Programme syllabus

Faculty Board of Science and Engineering  
School of Engineering

Bioenergiteknik, masterprogram, 120 högskolepoäng  
Bioenergy Technology, Master Programme, 120 credits

### Level

Second Level

### Establishment of Programme

Established by Organisational Committee 2009-09-02

### Date of Ratification

Approved by Organisational Committee 2009-09-15

The programme syllabus is valid from autumn semester 2010

### Prerequisites

General entry requirements for second-cycle studies and specific entry requirements:

- Degree of Bachelor of Science or Technology or the equivalent
- Knowledge in Chemistry or Technical Chemistry equivalent to 15 credits
- English B/6 or the equivalent.

### Description of Programme

The programme gives a deeper insight in energy technology with special emphasis on bioenergy technology and prepares for a professional career in industry, in the public sector, or for further studies at the doctorate level.

The programme aims to deepen the student's insight about the conditions and the technologies for (bio-)fuel-based energy supply in the form of electricity, heat or coling, as well as to introduce the student to relevant methods for research and development.

Primarily, the programme prepares the student for a future career as an analyst, environmental controller, consultant or alike in private sector or in the public sector. The programme also offers professional engineers active in the area a possibility for vocational training and to deepen and update their knowledge in the area.

### Objectives

Knowledge and understanding

For a Degree of Master (Two Years) students must

- demonstrate knowledge and understanding in their main field of study, including both broad knowledge in the field and substantially deeper knowledge of certain parts of the field, together with deeper insight into current research and development work; and
- demonstrate deeper methodological knowledge in their main field of study.

## Skills and abilities

For a Degree of Master (Two Years) students must

- demonstrate an ability to critically and systematically integrate knowledge and to analyse, assess and deal with complex phenomena, issues and situations, even when limited information is available;
- demonstrate an ability to critically, independently and creatively identify and formulate issues and to plan and, using appropriate methods, carry out advanced tasks within specified time limits, so as to contribute to the development of knowledge and to evaluate this work;
- demonstrate an ability to clearly present and discuss their conclusions and the knowledge and arguments behind them, in dialogue with different groups, orally and in writing, in national and international contexts; and
- demonstrate the skill required to participate in research and development work or to work independently in other advanced contexts.

## Judgement and approach

For a Degree of Master (Two Years) students must

- demonstrate an ability to make assessments in their main field of study, taking into account relevant scientific, social and ethical aspects, 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 developing their knowledge.

## *Programme specific goals*

### Knowledge and understanding

For a Degree of Master (Two Years) students must

- demonstrate a general knowledge and understanding for the societal need of an energy supply system based on ecological, economical and social sustainability
- demonstrate a general knowledge concerning technical and environmental characteristics of fuel-based energy production.
- demonstrate a comprehensive knowledge about methods used in research and development within the area of fuel based energy production..

### Skills and abilities

For a Degree of Master (Two Years) students must

- demonstrate an ability to independently formulate, analyze, solve and report technical problems in the field.
- demonstrate an ability to express demands and use tools to adopt and/or improve efficiency and environmental performance in plants.
- demonstrate an ability to plan and carry out independently projects demanding the above skills, and
- demonstrate the ability to, in a professional way, orally as well as in written form, present problems, describe and analyse the problem and, finally, present the result of the investigation

### Judgement and approach

For a Degree of Master (Two Years) students must

- demonstrate an ability to view the energy supply system from a holistic perspective, i.e. to judge the relevance and applicability of different types of plants or technologies with respect to system performance
- demonstrate an ability to make use of and appreciate results from research and

development work within the area to suggest individual ideas about improvement or development work

and

demonstrate an ability to identify the need for individual progression in the area and to take responsibility for the individual development

## Content

### *Organization*

The programme is lead by one person - the programme responsible. For all programmes in Bioenergy technology, there is a common reference group containing representatives from industry, from the faculty and from the students. The programme is built-up by predefined courses, together comprising the aims of the programme.

### *Programme overview*

The single most important - but at the same time the one with the most environmental impact - process in fuel-based energy supply, is the combustion process. Hence, the programme starts with an advanced level course in combustion technology. Students who do not fulfil the prerequisites for this course are offered the possibility to gain this required basis by following a separate course during the first part of the semester. Other students have a free choice during this same period.

The second important aspect in biofuel-based energy systems is the supply and the management of the material flows and therefore the second half of the first semester is a major course in logistics. This course is offered by the department of forestry and consists of lectures (about 1/3) and a large individual project. The students' understanding of the supply chain will later be further enhanced in the course "Assessment of biofuel resources".

During the second semester, the students shall start to integrate their own knowledge and synthesize it. The course "Unit operations in bioenergy systems" is the first step in this process. The course treats the unit operations during collection/harvesting, storage-pretreatment-upgrading and energy extraction through combustion and gasification. Finally, post-process treatment of effluents like flue-gases and process water as well as ash-recirculation are treated. The students' integral view of the system is further enhanced in the course "Project work and methodology" during the third semester. At the same time, the student is supplied with the theoretical tools for a realistic planning through a course in mathematical statistics. This course treats mathematical distributions and their properties with the aim to provide the student with the tools necessary to evaluate experimental or statistical data.

On top of this, the student has free choice of two courses to specialize.

The course "Assessment of biomass resources (for energy)" aims to deepen the students' insight in the methods available for resource assessments. During the lapse of the course, the student will compare two common methods and analyze the differences between them. The students shall also make a simple assessment.

The expected professional role for students with a Master's degree involve planning and management of very complex and advanced systems. The course "Project work and methodology" aims at preparing the student for this type of work by letting them try it in realistic cases. The course consists of a set of lectures (about 20 % of the course) but is centered around a real case provided by industry. The students shall deliver a complete technical, economical and environmental assessment of the problem provided. This course is given in co-operation with the technical university in Lund.

During the third semester another course is also offered concerning scientific methodology. This course is co-ordinated with other departments in the Technical faculty at the Linnæus University.

Courses in the programme

Semester 1:

Combustion Technology II (7.5 cred, advanced level)

Logistics (15 cred, advanced level)

Free choice 7.5 cred alt. Combustion Technology I, 7.5 cred)

Semester 2:

Unit operations in bioenergy systems (7.5 cred, advanced level)

Mathematical statistics (7.5 cred, base level)

Free choice 15 cred.

Semester 3:

Project work and methodology (15 cred, advanced level)

Assessment of biomass resources (7.5 cred, advanced level)

Scientific methodology (7.5 cred, advanced level)

Semester 4:

Degree Project (30 cred, advanced level)

### *Community contacts*

As said, all programmes in the Bioenergy area are planned in close co-operation with industries. Also the major projects during the programme are chosen in co-operation with relevant industry. The department of Bioenergy Technology also maintains close contacts with the public sector in the area and with public utility (energy) companies so as to produce relevant and applicable research. This also affects the programme content.

### *Studies abroad*

Students wanting to study abroad are advised to do so during the second semester - since the compulsory course "Unit operations..." is offered also as a distance learning course. At the same time, the student may study mathematical statistics at any University, since this is a general subject, and the student may study the courses of free choice at any university.

The second alternative for the student is to do the masters' work at any university abroad.

### *Scope of programme*

Sustainable development and gender

Education in the area of renewable energy must be based on a fundamental understanding of the need for sustainable development in which questions about class, gender, global resources, equity and international perspectives are natural parts. In this specific programme, the courses concerning resource assessments - as well as those concerning the whole system - the ones in which these perspectives are most prominent.

Diversity and internationalization

Diversity with respect to cultural background is automatically part of all courses offered on the international market. In the programme are included two such courses - offered internationally via distance learning technology.

**Quality Development**

NO VALUE DEFINED

## Degree Certificate

After completing programme studies, corresponding to the requirements expressed in the Higher Education Ordinance degree order as well as Linnaeus University degree order, the student may apply for a degree. Those who have completed the programme may obtain the following degree:

Teknologie masterexamen  
Huvudområde: Bioenergiteknik

*Master of Science (120 credits)*  
Main field of study: Bioenergy Technology

The certificate is bilingual (Swedish/English).  
Enclosed with the certificate is also a Diploma Supplement in English.