Programme syllabus

Master's Programme, Sustainable Energy Engineering, 120 credits
Masterprogram, hållbar energiteknik
120.0 credits

Valid for students admitted to the education from autumn 19 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

In addition to the objectives specified in the Swedish Higher Education Ordinance, there are also specific objectives for this programme. Graduates from the programme shall…

Knowledge and understanding

- have a broad scientific foundation that enables them to work within the fields of energy engineering. This applies to knowledge on sustainable systems in terms of energy sources and use, as well as the assessment of technical, economic and environmental implications related to different energy conversion processes.
- demonstrate broad knowledge within this technical field, including knowledge in mathematics and natural science, and substantial specialised knowledge within certain parts of the field.

Skills and abilities

- demonstrate a good ability to, independently and in a group, apply knowledge and skills in practice while taking into account relevant scientific, professional/profession-related and societal assessments and standpoints
- demonstrate a good ability to analyse, formulate and manage technical problems from a systems perspective, with a holistic view of their life cycle, from concept/requirements to specification, development, operation and decommissioning, and an ability to set boundaries, determine the necessary resource consumption and manage processes for problem-solving/realisation
- possess individual and professional skills, such as in the area of language, leadership, project management and communication, to work as an engineer in a management position or as a leader within a technology-intensive company, or to be able to continue towards a research career.

Ability to make judgements and adopt a standpoint
• have a particularly good understanding of the fact that engineering problems are often complex, can be incompletely defined and sometimes involve conflicting conditions

• be aware of the responsibilities and ethical standpoints that may arise in connection with various technical, organisational, economic, ecological and societal activities

**Extent and content of the programme**

The programme comprises 120 credits, which corresponds to 2 years of full-time studies. The programme is in the second cycle and the language of instruction is English.

Elective specialisation areas (profiles) for the programme are within Sustainable Energy Utilisation, Power Generation, Solar Energy and Transformation of Energy Systems/Policy and Management.

**Eligibility and selection**

Eligibility for the Master's Programme requires a relevant university education of at least 180 credits, a Bachelor of Science in Engineering or a technical Degree of Bachelor within the subject area of mechanical engineering or chemical engineering. Another similar technical or scientific first-cycle education may also qualify the applicant. Courses in engineering thermodynamics, heat transfer and fluid mechanics for engineers are included in the admission requirements. English skills equivalent to English, course B/6.

These skills may be assessed as NOT complete if:

- the University from where the degree has been issued is deemed, by local authorities, not to be of acceptable quality and standard.

- the degree is not acceptable for master level studies in the country where it has been issued.

The selection process is based on the following criteria: university, credits awarded (e.g. grades, grades in specific subjects and English), motivation for the studies (for instance, letter of motivation, references, courses and relevant professional experience providing such proof is not mandatory though). The assessment of qualifications scale is 1-75.

Otherwise refer to the KTH admission regulations in the KTH regulatory framework, www.kth.se

**Implementation of the education**

**Structure of the education**

**Academic year**

Each academic year consists of two semesters which are 20 weeks each. Each semester is divided into two study periods.

**Structure of the programme**

The programme begins with a common course package during semester 1 which provides a solid base for
the profiles provided during semester two and three. The third semester includes advanced studies within the field of energy with a research preparatory perspective. The programme concludes with a degree project during semester 4.

Courses

The programme is course-based. Lists of courses are included in appendix 1.

The programme is structured in the form of courses. Course lists are found in appendix 1. The programme consists of compulsory, conditionally elective, recommended and optional courses.

The compulsory courses are defined for each year and profile in course lists. The goals, entrance qualifications, content and course requirements for each course can be found in the official course syllabuses.

The forms of instruction and examination vary between the courses and these are indicated in each official course syllabus.

The optional courses can be chosen from KTH's range of offered courses. Credits from courses at other universities/higher education institutions can also be transferred if the qualification requirements are met.

The following limitations apply to optional courses:

- There is a limit imposed on the number of credits that may be chosen per semester
- An optional course may not correspond to a significant extent to an existing programme course or an already credited course
- Higher education preparatory courses may not be counted as optional courses
- Optional courses may be chosen freely but should be relevant to the professional role of engineer.

Grading system

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Grading scale is found in the course syllabus.

Conditions for participation in the programme

Participation requires admission to courses within the programme and course registration.

For studies at a higher study year there are specific admission requirements for the courses. Admission requirements are specified in the course syllabus.

Selection of profile

Selection of profile is done by registration for courses prior to semester 2.
Degree project

Degree project, second cycle
The programme includes a degree project for a Degree of Master that comprises 30 credits.

In order to fulfill specific admission requirements for a Degree Project, Second Cycle, 30 credits, courses corresponding to at least 60 credits, second cycle, must be completed. The courses at the second cycle shall include courses in the programme relevant to the degree project, as well as courses in science theory and research methodology.

Degree

Conditions for a Degree of Master, 120 credits
A Degree of Master of Science is obtained after completing the degree programme. The programme is designed so that the student, when they graduate, has fulfilled the national qualification requirements with a passing grade in all courses included in the student's study plan of 120 credits, of which

- at least 90 credits are attained in the second cycle, which includes at least 60 credits (including a 30 credit degree project) of specialised studies within the programme's main field of study.

Title of general qualification at second cycle
Degree of Master of Science (120 credits) Teknologie masterexamen

Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
# Appendix 1: Course list

Master's Programme, Sustainable Energy Engineering, 120 credits (TSUEM), Programme syllabus for studies starting in autumn 2019

## General courses

### Year 1

### Mandatory courses (36.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJ2405</td>
<td>Sustainable Power Generation</td>
<td>9.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2407</td>
<td>Sustainable Energy Utilisation</td>
<td>9.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2410</td>
<td>Energy Management</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2411</td>
<td>Renewable Energy Technology</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2413</td>
<td>Energy and Environment</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

### Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME2085</td>
<td>Transformation in Energy Systems and Industries</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ME2087</td>
<td>Profile: &quot;Transformation of Energy Systems: Policy and Management&quot;</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ME2090</td>
<td>Energy Business</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2381</td>
<td>Introduction to Energy Systems Analysis and Applications - Minor Course</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2412</td>
<td>Renewable Energy Technology, Advanced Course</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2422</td>
<td>Thermal Comfort and Indoor Climate</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
MJ2423  Applied Refrigeration and Heat Pump Technology  6.0 hp  Second cycle
Profile: "Sustainable Energy Utilization"

MJ2424  Computational Methods in Energy Technology  6.0 hp  Second cycle

MJ2426  Applied Heat and Power Technology  6.0 hp  Second cycle
Profile "Sustainable Power Generation"

MJ2476  Strategies in the Global Climate Agenda  6.0 hp  Second cycle
Profile:"Transformation of Energy Systems: Policy and Management"

MJ2500  Large Scale Solar Power  6.0 hp  Second cycle
Profile: "Solar Energy"

MJ2501  Solar Energy Systems for Buildings and Cities  6.0 hp  Second cycle
Profile: "Solar Energy"

Recommended courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED2200</td>
<td>Energy and Fusion Research</td>
<td>6.0 hp  Second cycle</td>
</tr>
<tr>
<td>MJ2244</td>
<td>Airbreathing Propulsion, Intermediate Course I</td>
<td>6.0 hp  Second cycle</td>
</tr>
<tr>
<td>MJ2246</td>
<td>Rocket Propulsion</td>
<td>6.0 hp  Second cycle</td>
</tr>
<tr>
<td>MJ2430</td>
<td>Thermal Turbomachinery</td>
<td>6.0 hp  Second cycle</td>
</tr>
<tr>
<td>MJ2437</td>
<td>Modeling of Energy Systems - Energy Utilization</td>
<td>6.0 hp  Second cycle</td>
</tr>
<tr>
<td>MJ2472</td>
<td>Energy Planning and Applications</td>
<td>9.0 hp  Second cycle</td>
</tr>
</tbody>
</table>

Supplementary information

One profile must be chosen during year 1:

**Sustainable Energy Utilization**
(mandatory courses: MJ2422, MJ2423, MJ2424)

**Sustainable Power Generation**
(mandatory courses: MJ2412, MJ2424, MJ2426)

**Solar Energy**
(mandatory courses: MJ2500, MJ2501, MJ2424)

**Transformation of Energy Systems: Policy and Management**
(mandatory courses: ME2087, ME2085, MJ2476, MJ2381)

**Year 2**
# Mandatory courses (18.0 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJ2409</td>
<td>Applied Energy Technology, Project Course</td>
<td>9.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2440</td>
<td>Measurement Techniques</td>
<td>3.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2475</td>
<td>Theory and Methodology of Science for Energy Research</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

# Recommended courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG2340</td>
<td>Wind Power Systems</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ME2086</td>
<td>Global Energy Markets and Systems in Transition</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2383</td>
<td>Energy System Economics, Modelling and Indicators for Sustainable Energy Development</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2429</td>
<td>Turbomachinery</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2434</td>
<td>Advanced Refrigeration and Heat Pump Technology</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2460</td>
<td>Green Building - Concept, Design, Construction and Operation</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2462</td>
<td>Achieving Energy Efficiency in Existing Buildings</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2477</td>
<td>Energy Policy and Planning</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2503</td>
<td>Small Scale Polygeneration</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2505</td>
<td>Practical Optimization of Energy Networks</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

# Supplementary information

## Recommended courses, but not mandatory:

### Sustainable Energy Utilization
(Recommended courses: MJ2434, MJ2460, MJ2462)

### Sustainable Power Generation
(Recommended courses: MJ2420, MJ2429, MJ2505)

### Solar Energy
(Recommended courses: MJ2503, MJ2505, MJ2460, EG2340)

### Transformation of Energy Systems: Policy and Management
(Recommended courses: MJ2477, ME2086, MJ2383)

**Mandatory:** Master thesis project, 30 cr.
Appendix 2: Specialisations

Master's Programme, Sustainable Energy Engineering, 120 credits (TSUEM), Programme syllabus for studies starting in autumn 2019

This programme has no specialisations.