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 16 (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

The KTH local Degree Ordinance can be found in the KTH regulatory framework, www.kth.se.

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 energy efficiency, sustainable power generation, solar energy, turbomachinery, and conversion 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 average grade is in the lower third of the grading scale used.

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). 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*

The academic year comprises 40 weeks and is divided into four periods. If necessary, instruction may be provided outside the parameters of the academic year.

The division of the academic year is presented on the KTH student web www.kth.se

*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 track/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
A seven-grade criterion-referenced grading scale A-F is used for courses at KTH as final grades for courses at first and second cycle.

A–E are grades corresponding to a pass, with A being the highest grade.
The grades pass (P) and fail (F) are used as final grades when there are special reasons.

Conditions for participation in the programme

Semester registration
At the beginning of the semester, the student must submit a compulsory semester registration via their personal login at www.kth.se

Semester registration is required to take new courses and for credits awarded to be reported, and for any payments of student aid to be made by CSN.

Approved leave from studies
Approved leave from studies means that the student does not participate in the teaching for at least one study period. Approved leave from studies entitles the student to return to the studies at a specified time. During their approved leave from studies, the student may engage in supplementary tasks and participate in the examination of previously commenced courses.

Applications for approved leave from studies are made using a form that is submitted to the school's office of student affairs. When a student intends to resume their studies, they should submit a new study application according to instructions from the school's office of student affairs.

For more information, see the KTH regulatory framework, www.kth.se

Application for courses within the programme
Prior to each semester, the student must apply for all courses the student intends to take. Course application is done at www.antagning.se or www.universityadmissions.se

· 1 - 15 May for autumn semesters
· 1 - 15 November for spring semesters

If the student does not apply via www.antagning.se or www.universityadmissions.se, the application is only considered subject to availability.

The student can obtain information on how to apply from the school's office of student affairs.

Course registration
Course registration requires that the student is admitted to the course. At course start, the student must register on the course to which they have been admitted. Course registration must be done individually, either via the student's personal login at www.kth.se or according to instructions from the school offering the course.

A person who has registered on a course, but has subsequently decided not to proceed with the course, must inform the school offering the course as soon as possible, according to the school's instructions.

Choice of track

Choice of track is made through applying to courses in semester 2

Conditions for participation in the instruction Conditions for moving up for studies in year 2
At least 45 credits from year 1, according to the course list of the programme syllabus, shall be earned by the end of the re-examination period in August.
Individual study plan
A student who does not fulfil the above requirements must, in consultation with the study advisor for the programme, establish an individual study plan for the continuing studies.

An individual study plan may mean that the student cannot be guaranteed full-time studies.
See the KTH regulatory framework: www.kth.se

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.

Conditions for participation in the programme

Semester registration
At the beginning of the semester, the student must submit a compulsory semester registration via their personal login at www.kth.se

Semester registration is required to take new courses and for credits awarded to be reported, and for any payments of student aid to be made by CSN.

Application for courses within the programme
Prior to each semester, the student must apply for all courses the student intends to take. Course application is done at www.antagning.se or www.universityadmissions.se

- 1 - 15 May for autumn semester
- 1 - 15 November for spring semester

If the student does not apply via www.antagning.se or www.universityadmissions.se, the application is only considered subject to availability.

The student can obtain information on how to apply from the school's office of student affairs.

Course registration
At course start, the student must register themselves on all courses. Course registration must be done individually, either via the student's personal login at www.kth.se or according to instructions from the school offering the course.

A person who has registered on a course, but has subsequently decided not to proceed with the course, must inform the school offering the course as soon as possible, according to the school's instructions.

Course registration requires that the student has been admitted to the course.

Conditions for studies in year 2
At least 45 credits from year 1, according to the course list of the programme syllabus, shall be earned by the end of the re-examination period in August.

Individual study plan
A student who does not fulfil the above requirements must, in consultation with the programme study advisor, establish an individual study plan for the continuing studies.

There are no guarantees for full-time studies for students with an individual study plan
See the KTH regulatory framework: www.kth.se

Recognition of previous academic studies
Students have the opportunity to apply to be given credit for results from a course or courses at another higher education institution/university within or outside the country. The entire KTH policy for credit transfer is included in KTH's regulatory framework, www.kth.se
As the grading systems differ widely between countries, grades from exchange studies are not translated to the KTH grading scale.

An application is made by submitting a form to the school's office of student affairs.

**Studies abroad**

There are numerous opportunities to go on a foreign exchange within the programme, for example, between year 1 and 2 or for a degree project. Some exchanges can take place with the help of scholarships, e.g., Minor Field Studies.

The application deadline for studies abroad is around 15 December for the following academic year.

**Degree project**

Degree project, second cycle
The programme includes a degree project for a Degree of Master that comprises 30 credits and which is usually carried out in the spring semester of year 2.

Commencement of the degree project requires that the majority of the studies in the Master's Programme are completed, i.e.,

- that 60 credits have been obtained, of which 30 credits relate to specialised studies in the second cycle within the Master's Programme.

KTH's comprehensive rules and guidelines for a degree project, 30 credits, for a Degree of Master, 120 credits, can be found in the KTH regulatory framework. www.kth.se

**Degree**

Application for a certificate
The student must apply for a certificate. Applications are made by logging on to the KTH website where "Applications for degrees" is found under the heading Programme.

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

Refer to the KTH guidelines (KTH regulatory framework), local directions for higher education qualifications at first and second cycle, the local Degree Ordinance www.kth.se

**Appendix 1** Course lists for different years and possible specialisations

**Appendix 2** Description of possible specialisations

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 2016

#### General courses

**Year 1**

**Mandatory courses (39.0 credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJ1402</td>
<td>Introduction to Energy Technology</td>
<td>3.0</td>
<td>First cycle</td>
</tr>
<tr>
<td></td>
<td><em>Not compulsory for civ ing.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2405</td>
<td>Sustainable Power Generation</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2407</td>
<td>Sustainable Energy Utilisation</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2410</td>
<td>Energy Management</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2411</td>
<td>Renewable Energy Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Not compulsory for civ ing. (Compulsory for Profile Power generation)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2413</td>
<td>Energy and Environment</td>
<td>6.0</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</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile Transformation of energy systems: Policy and management</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME2087</td>
<td>Energy Business</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile Transformation of energy systems: Policy and management</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2244</td>
<td>Airbreathing Propulsion, Intermediate Course I</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile Turbomachinery, only one of MJ2244 or MJ2430 can be chosen.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2381</td>
<td>Introduction to Energy Systems Analysis and Applications - Minor Course</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile Transformation of energy systems: Policy and management</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2412</td>
<td>Renewable Energy Technology, Advanced Course</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile Sustainable power generation</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2422</td>
<td>Thermal Comfort and Indoor Climate</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile Sustainable energy utilization</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course code</td>
<td>Course name</td>
<td>Credits</td>
<td>Edu. level</td>
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<tr>
<td>MJ2423</td>
<td>Applied Refrigeration and Heat Pump Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile: Sustainable energy utilization</em></td>
<td></td>
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</tr>
<tr>
<td>MJ2424</td>
<td>Computational Methods in Energy Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profiles: Sustainable energy utilization, Sustainable power generation, Solar energy and Turbomachinery</em></td>
<td></td>
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<tr>
<td>MJ2426</td>
<td>Applied Heat and Power Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile: Sustainable power generation</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2429</td>
<td>Turbomachinery</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile: Turbomachinery (compulsory, and a prerequisite for MJ2430)</em></td>
<td></td>
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</tr>
<tr>
<td>MJ2430</td>
<td>Thermal Turbomachinery</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile: Turbomachinery, only one of MJ2244 or MJ2430 can be chosen (for MJ2430, MJ2429 is needed)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2441</td>
<td>Design of Photovoltaic and Hybrid Systems</td>
<td>5.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile: Solar energy</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2442</td>
<td>Solar Heating Systems</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile: Solar energy</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2476</td>
<td>Strategies in the Global Climate Agenda</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Profile: Transformation of energy systems: Policy and management</em></td>
<td></td>
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</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>MJ2246</td>
<td>Rocket Propulsion</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Recommended for profile: Turbomachinery</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2437</td>
<td>Modeling of Energy Systems - Energy Utilization</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Recommended for profile: Sustainable Energy Utilization</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Recommended for profile: Sustainable Power generation</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MJ2472</td>
<td>Energy Planning and Applications</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

**Supplementary information**

One profile must be chosen:

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

**Power Generation**
(mandatory courses: MJ2424, MJ2411, MJ2412, MJ2426)

**Solar Energy**
(mandatory courses: MJ2424, MJ2411, MJ2441, MJ2442)

**Turbomachinery**
(mandatory courses: MJ2424, MJ2429, MJ2430 or MJ2444)
Transformation of Energy Systems: Policy and Management
(mandatory courses: ME2087, ME2085, MJ2476, MJ2381)

The courses: MJ2405, MJ2407, MJ2410, MJ2413 are compulsory for civil engineering.

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</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2440</td>
<td>Measurement Techniques</td>
<td>3.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2475</td>
<td>Theory and Methodology of Science for Energy Research</td>
<td>6.0</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>ME2086</td>
<td>Global Energy Markets and Systems in Transition</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2382</td>
<td>Energy Data, Balances and Projections</td>
<td>6.0</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</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2420</td>
<td>Combustion Theory</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2429</td>
<td>Turbomachinery</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2434</td>
<td>Advanced Refrigeration and Heat Pump Technology</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2460</td>
<td>Green Building - Concept, Design, Construction and Operation</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2462</td>
<td>Achieving Energy Efficiency in Existing Buildings</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2477</td>
<td>Energy Policy and Planning</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Supplementary information

Recommended courses that can be chosen, but not mandatory:

**Sustainable Energy Utilization**
(Recommended courses: MJ2434, MJ2425, MJ2460, MJ2462)

**Power Generation**
(Recommended courses: MJ2429, MJ2420)

**Solar Energy**
(Recommended courses: MJ2477, ME2086, MJ2382, MJ2383)

**Mandatory:** Master thesis project, 30 cr.
Year 3
Appendix 2: Specialisations

Master's Programme, Sustainable Energy Engineering, 120 credits (TSUEM), Programme syllabus for studies starting in autumn 2016

This programme has no specialisations.