



Programme syllabus

[An accessible version of the syllabus can be found in the Course and programme directory.](#)

Master's Programme, Environomical Pathways for Sustainable Energy Systems 120 credits

Masterprogram, miljövänliga energisystem

Valid for students admitted to the education from autumn 20 (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 Degree Ordinance of the Swedish Higher Education Ordinance, there are also specific objectives for this programme. On completion of this programme, the student shall:

Knowledge and understanding

- Have a broad scientific foundation that enables them to work within the field of energy technology. This should include energy knowledge on sustainable energy systems, energy sources and their use, and an assessment of the technical, economic and environmental implications related to various energy conversion processes
- Demonstrate broad knowledge within this technical field, including knowledge in mathematics and natural science, and in particular 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 practical activities while taking into account relevant scientific, professional and social 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/requirement specification, development, operation and decommissioning, and an ability to set boundaries, determine the necessary use of resources and manage processes for problem-solving and 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 very good understanding of the fact that engineering problems are often complex, can be incompletely defined and sometimes involve conflicting objectives and conditions
- Be aware of the responsibilities and ethical considerations that may arise in connection with various technical, organisational, economic, ecological and social processes

Extent and content of the programme

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

The Programme is offered within the framework of master's programmes, the KIC InnoEnergy MSc School.

Partner Universities in the programme Environmental Pathways for Sustainable Energy Systems (SELECT) are:

- KTH – Royal Institute of Technology, Stockholm, Sweden
- Aalto – Aalto University School of Science and Technology, Finland

- TU/e – Eindhoven University of Technology, Netherlands
- PoliTo – Politecnico di Torino, Italy
- UPC – Barcelona Tech
- IST – Instituto Superior Técnico, Portugal
- AGH – AGH University of Science and Technology, Poland

Possible specialisation areas for the programme:

Specialisations for semester 3 and 4:
 Sustainable Biomass Processing (Aalto)
 Innovation in Energy Systems (TU/e)
 Solar Systems (UPC)
 Polygeneration (KTH)
 Energy Efficiency (PoliTo)
 Sustainable Fuels Economy (AGH)
 Offshore Energy Systems (IST)

The language of instruction for the programme is English.

Eligibility and selection

In order to be eligible to the master's programme, a relevant higher education degree of at least 180 credits, degree of bachelor in natural science or in engineering, or technical bachelor's degree preferably within Mechanical Engineering, energy/environmental or Chemical Engineering is required. Other equivalent technical or science degrees on the first level can also give eligibility.

Eligibility may however be assessed as not fulfilled if:

- The degree awarding institution is not considered to meet acceptable quality standards by the authorities of the country in which the institution is located
- The degree does not qualify for admission to equivalent Master level in the country where the degree is awarded

Other studies or work experiences are judged on the basis of the actual competences which are referred to.

A sound and documented knowledge of written and spoken English equivalent of TOEFL score minimum 580 (paper) or 92 (internet) and the writing section fulfilling the minimum requirement of 4.5 or 22, respectively; or IELTS score minimum 6.5 and the each section fulfilling the minimum requirement of 5.5; or Cambridge Certificate in Advanced English (CAE) or Cambridge Certificate of Proficiency in English (CPE), minimum grade "C" is required from all applicants.

The selection of students to the programme is performed by the steering committee of the programme, consisting of representatives from all partner universities, and in compliance with the directives given by the KIC InnoEnergy.

All KIC InnoEnergy applications will be handled by Karlsruhe Institute of Technology (KIT).

The selection process is based on the following selection criteria: University, previous studies (for instance GPA, grades in specific subjects and English), motivation for the studies (for instance letter of motivation, references, thesis proposal and relevant work experience). The evaluation scale is 1-75.

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.

All KIC InnoEnergy applications will be handled by Karlsruhe Institute of Technology (KIT).

Structure of the programme

The programme extends over four semesters of which the first two, i.e. year 1, are given at either KTH or UPC. The third and fourth semesters, i.e. year 2, is chosen by the students, among the all partner universities (KTH, PoliTo, Aalto, TU/e, UPC, AGH and IST) according to their desired field of specialization, including the area for their MSc thesis. However, the choice must be such that the programme's mandatory mobility condition is met which, for example, means that a student studying year 1 at KTH MUST choose another university and area of specialization for year 2. In the fourth (final) semester the students can perform the MSc thesis in an industrial setting in common supervision with researchers/teachers from the student's 2nd year university.

The first two semesters are considered fundamental within the field of sustainable energy systems, and renewable energy. Integrated in the year 1 curriculum is also energy management and introductory business and entrepreneurship training. In the second semester, the first programme spring seminar is given at one of the partner universities.

In this spring seminar, the topic is cutting-edge research in the field. Between the second and third semesters, a Summer Internship is performed where students combine their learning experiences from semesters 1 and 2 to a basic environmental problem in industry. During the third and fourth semesters the partners other than KTH offer courses within eight fields of specialization (see above), along with a common 7 ECTS compulsory course containing advanced environmental material. Also, during the second year the students apply their knowledge on a project in industry or at one of the partner universities to constitute the basis for the master thesis. This includes the second compulsory spring seminar given for one week at one of the partner universities with an advanced discussion on research in the area. The programme ends with a common, degree ceremony at one of the partner universities.

Courses

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

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

The student must register for the individual courses in the way each one of the partner universities decides.

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.

Since the programme is a cooperation agreement between KTH and four other universities, other types of grading might be used.

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.*

Specialisation Selection

There is no limitation to the number of places available at each partner university.

Recognition of previous academic studies

Students wishing recognition of previous academic studies must submit an application to the Programme Steering Committee.

Degree project

Degree project, second cycle

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.

To start the degree project at least 80 ECTS course credits should have been achieved, all compulsory assignments should have been attempted and at least 90% of these assignments should have been passed.

In order to fulfil requirements for obtaining a master degree the project must be part of the required in-depth studies at second level in the main field of study for the programme. The topic of the project must be accepted by the Programme Steering Committee.

The project can be performed either at an industry, community, agency or at one of the partner universities.

The partner universities might have special requirements for the degree project.

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

Depending on the chosen track of studies, a double degree may be issued from one of the partner universities.

Appendix 1 - Course list

Appendix 2 - Programme syllabus descriptions



Appendix 1: Course list

Master's Programme, Environomical Pathways for Sustainable Energy Systems (TMESM)

General courses

Year 1

Mandatory courses (60.0 Credits)

| Code | Name | Credits | Edu. level |
|------------------------|---|---------|--------------|
| MJ2404 | Energy Conversion Systems | 6.0 hp | Second cycle |
| MJ2411 | Renewable Energy Technology | 6.0 hp | Second cycle |
| MJ2412 | Renewable Energy Technology, Advanced Course | 6.0 hp | Second cycle |
| MJ2414 | Energy Systems Analysis in an Environomical Context | 6.0 hp | Second cycle |
| MJ2415 | Project in Energy Systems Analysis | 12.0 hp | Second cycle |
| MJ2416 | Microeconomics and Energy Markets | 5.0 hp | Second cycle |
| MJ2418 | Sustainable Energy and Environment | 5.0 hp | Second cycle |
| MJ2419 | Energy Storage Systems | 4.0 hp | Second cycle |
| MJ2497 | Energy Efficiency and Rational Use of Energy | 5.0 hp | Second cycle |
| MJ2498 | Energy Resources | 5.0 hp | Second cycle |

Supplementary information

First study year at KTH or UPC

A Language course can be chosen in agreement with program coordinator

Year 2

Mandatory courses (18.0 Credits)

| Code | Name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| MJ2502 | Industrial Dynamics of Innovation in Combined Energy Systems | 6.0 hp | Second cycle |
| MJ2503 | Small Scale Polygeneration | 6.0 hp | Second cycle |
| MJ2504 | Integrated Project of the Year in Sustainable Energy | 6.0 hp | Second cycle |

Recommended courses

| Code | Name | Credits | Edu. level |
|------------------------|--|---------|--------------|
| MJ2383 | Energy System Economics, Modelling and Indicators for Sustainable Energy Development | 6.0 hp | Second cycle |
| MJ2405 | Sustainable Power Generation | 9.0 hp | Second cycle |
| MJ2434 | Advanced Refrigeration and Heat Pump Technology | 6.0 hp | Second cycle |
| MJ2440 | Measurement Techniques | 3.0 hp | Second cycle |
| MJ2460 | Green Building - Concept, Design, Construction and Operation | 6.0 hp | Second cycle |
| MJ2462 | Achieving Energy Efficiency in Existing Buildings | 6.0 hp | Second cycle |
| MJ2477 | Energy Policy and Planning | 6.0 hp | Second cycle |

Supplementary information

MJ2504 "Integrated project of the year in sustainable energy" 6 credits must be taken by all students admitted to TMESM regardless "study track"/partner University. (period 1-4)

A master thesis is mandatory - MJ218x



Appendix 2: Specialisations

Master's Programme, Environomical Pathways for Sustainable Energy Systems (TMESM)

This programme has no specialisations.