

MS ISEE Study track: Bioenergy, Course Table: 2016/2017

1. **Year KTH:** Department of Energy Technology, Mark Howells
2. **Year Aalto University,** School of Engineering/Department of Mechanical Engineering, Prof. Mika Järvinen

Study track focus and goals:

The Bio Energy study track provides state-of-the-art education in thermal conversion of biomass into power and biofuel production. Thermal conversion of biomass is considered one of the main methods to reduce carbon dioxide emissions and in the replacement of fossil carbon sources. This is due to the fact that biomass is a carbon neutral fuel as the emitted CO₂ was previously captured from the atmosphere by the plants being thermally processed. Power generation technology from biomass can be achieved through different processes, for example: combustion, gasification, pyrolysis and combined processes. While biofuel production technology can be achieved through pyrolysis, gasification, fermentation and/or distillation process.

The Bio Energy study track at Aalto University for second year includes two modules: Power Generation from Biomass and Bioenergy in Transport. The Power Generation from Biomass module focuses on sustainable production of power from biomass which includes all aspects related to bio-boilers principles, planning, structure and operation. The Bio energy in Transport module focuses on the use and usability and combustion of bio-derived fuels in transport. On-road, off-road and marine transport is covered. The basics of bio-fuel production principles are covered too. The courses of both modules consist of lectures, literature, simulation exercises, excursions, seminars and group project work.

Learning outcomes:

- Student acquire a state-of-the-art education and training in the fields of sustainable power generation from biomass and biofuel; become familiar with the principles, planning, structure and operation of bio-boilers, combustion and gasification techniques in different types of boilers; obtain constructive knowledge in biofuel production, use, combustion and relevant environmental aspects.
- Student become skilled in calculation, simulation, design and analysis of thermal processes in bio energy power plant through training in multidisciplinary problem analysis and solving with emphasis on critical thinking
- Close collaboration with industry during thesis work and organizing excursion for many courses (especially project work courses) to provide students with enough knowledge about biomass technology both in theory and practice.

Course table

1. Semester	2. Semester	3. Semester	4. Semester
KTH		Aalto University	
Introduction to Energy Technology, MJ1402, 3 ECTS	Computational Methods in Energy Technology, MJ2424, 6 ECTS	Bioenergy I, EEN-E2005, 5 ECTS	Thesis , 30 ECTS
Renewable Energy Technology, MJ2411, 6 ECTS	Energy Management, MJ2410, 6 ECTS	Bioenergy II, EEN-E2006, 5 ECTS	
Sustainable Power Generation, MJ2405, 9 ECTS	Renewable Energy Technology, Advanced course, MJ2412, 6 ECTS	Energy, Environment and Emission Control, EEN-E2007, 5 ECTS	
Sustainable Energy Utilization, MJ2407, 9 ECTS	Applied heat and power technology, MJ2426, 6 ECTS	Renewable Energy for Communities and Industry, EEN-E1050, 5 ECTS	
Energy and Environment, MJ2413, 6 ECTS	Elective course from list 1	Process-Integration, Simulation and Optimization, Ene-47.5130, 3 ECTS	
		Foreign language studies, Kie-98., 3 ECTS	
		Elective courses from list 2	
= 33 ECTC	= 30 ECTS	= 30 ECTS	= 30 ECTS

Elective course list 1

- MJ2438 – Modeling of Energy Systems – Heat and Power Generation, 6 ECTS
- MJ2470 Climate Change Mitigation Tools, 6 ECTS
- MJ 2473 Energy Policy Design, 6 ECTS

Elective course list 2

- PHYS-C6370 Fundamentals of New Energy Sources (5 ECTS) (I-II)
- EEN-E1010 Power Plants and Processes (5 ECTS) (I-II)
- Kie-98.1114 Communicating Technology (3 ECTS) (I-II)
- Kie-98.1115 Persuasive Communication (3 ECTS) (I-II, III-IV, IV-V)
- Kie-98.1410 Industrial Communications (3-5 ECTS) (I, III)

Research areas for projects / master thesis

Responsible professor, 2. year university, department	Second supervisor, 1. year, university, department	Research area
Prof. Mika Järvinen, Aalto University, department of Mechanical Engineering	Possible second supervisor, university, department	Combustion and gasification, fuel spraying and modeling
Prof. Martti Larmi, Aalto University, department of Mechanical Engineering	Possible second supervisor, university, department	Biofuel production and combustion
Prof. Risto Lahdelma, Aalto University, department of Mechanical Engineering	Possible second supervisor, university, department	Energy: Modeling, simulation and optimization
Prof. Pekka Ahtila, Aalto University, department of Mechanical Engineering	Possible second supervisor, university, department	Industry, energy technology and power plant engineering

Degree requirements for admission process

A BSc degree corresponding to a minimum 180 ECTS credits in the following fields:	Energy Engineering or Mechanical Engineering and Chemical Engineering
Applicants that are enrolled in an integrated five year degree with no bachelor level:	
A BEng in ... Engineering is accepted for start at ...	
Applicants with a BEng in ..., or a BSc or BEng in ..., will be considered on an individual basis.	
The applicant's qualifications must include a strong working knowledge of mathematics and ..., and applicants must document that they have fulfilled the following minimum requirements:	<p>The minimum requirements includes the following:</p> <ul style="list-style-type: none"> - Mathematics: 20 ECTS including linear algebra, calculus and differential equations. - Thermodynamics and heat transfer: 5 ECTS. - Energy & Environment: 5 ECTS - Statistics and dynamics: 5 ECTS. - Fluid mechanics: 5 ECTS. - Materials science: 5 ECTS. <p>Moreover, the applicant must have sufficient qualifications within numerical methods and elementary programming using e.g. MATLAB or a similar programming language.</p>
Applicants with a Polytechnic (FI), Högskoleingenör (SE) and Diplomingeniør (DK) degree may be expected to do extra course work to qualify for the programme.	