

MS ISEE Study Track: Heat and Power Engineering, Course Table: 2018/2019

1. **Year Aalto University:** School of Engineering, Dept. of Mechanical Engineering, Mika Järvinen
2. **Year Chalmers University of Technology:** Dept. of Energy and Environment, Carl Linderholm & Tobias Mattisson

Study track focus and goal:

This track meets the challenge set global warming and depletion of fossil fuel resources by providing state-of-the-art education in advanced technologies and systems for efficient, clean and competitive conversion, distribution and use of electricity, heating and cooling.

Training is provided in the use of optimization and modelling tools for design and planning on the technical plant level, including state-of-the-art technologies, at the same time that necessary knowledge on energy systems is given in order to gain perspective.

Learning outcomes:

- Students become skilled in analysis, optimization and design of combined heat and power plants and industrial heat processes, acquiring also state-of-the-art knowledge on technologies for fuel conversion with reduced or zero CO₂ emissions (biomass and waste conversion, Carbon Capture and Storage technologies).
- By acquiring complementary knowledge on an energy systems level, students are trained to approach problem-solving in an interdisciplinary way.
- Students are prepared for a professional career within the energy industry and power generation companies.

Course table

1. Semester	2. Semester	3. Semester	4. Semester
Aalto University		Chalmers University of Technology	
Biofuel & bioenergy, AAE-E3050, 5 ECTS	Combustion Technology, EEN-E2002, 5 ECTS	Heat and Power Systems Engineering, MEN120, 7.5 ECTS	Thesis , 30 ECTS
Energy Markets, EEN-E3006, 5 ECTS	Advances in New Energy Technologies, PHYS-E0483, 5 ECTS	Industrial Energy Systems, KVM013, 7.5 ECTS	
Energy, Environment and Emission Control, EEN-E2007, 5 ECTS	Exercises in Energy Technology, EN-E3005, 5 ECTS		
	Energy and Environmental Economics, 31E01310, 5 ECTS		
	District heating and cooling, EEN-E3004, 5 ECTS		
Elective courses from list 1	Elective courses from list 2	Elective courses from list 3	
= 25 ECTC	= 35 ECTS	= 30 ECTS	= 30 ECTS

Elective course list 1

- AAE-E1000 Introduction to Advanced Energy Solutions (5 ECTS)
- AAE-E3000 Advanced Energy Project (10 ECTS) (I-II)
- PHYS-E6572 Advanced Wind Power Technology (5 ECTS) (alternate years, not lectured autumn 2015)
- PHYS-C6370 Fundamentals of New Energy Sources (5 ECTS)

Elective course list 2

- PHYS-E6570 Solar Energy Engineering (5 ECTS) (alternate years, lectured in spring 2016)
- EEN-E2001 Computational Fluid Dynamics (5 ECTS)
- PHYS-C1380 Multi-disciplinary energy perspectives (5 ECTS)
- CHEM-E5145 Materials for Renewable Energy P (5 ECTS)

Elective course list 3

- Sustainable Electric Power Systems, ENM125, 7.5 ECTS
- Turbomachinery, TME210, 7.5 ECTS
- Sustainable Energy Futures , FFR170, 7.5 ECTS
- Computational fluid dynamics (CFD), MTF072, 7.5 ECTS
- Multiphase flow, TME160, 7.5 ECTS
- Gas turbine technology, MTF171, 7.5 ECTS
- Sustainable power production and transportation ENM095, 7.5 ECTS

Research areas for projects / master thesis

First and main supervisor at Chalmers University, 2nd year

Professors at Chalmers	Research area
Prof. Tobias Mattisson, Chalmers University, Energy and Environment	Chemical looping, gasification, thermodynamics
Prof. Filip Johnsson, Chalmers University, Energy and Environment	Fluidized bed processes
David Pallarès, Chalmers University, Energy and Environment	Fluidized bed processes
Fredrik Norrmann	Oxyfuel combustion, flue gas treatment
Mathias Gourdon	Optimization of industrial energy use
Magnus Rydén	Chemical looping combustion

Co-supervisors for master thesis supervision at Aalto University (i.e. 1st year university)

Professors at Aalto	Research area
prof. Mika Järvinen, Aalto University, department of Mechanical Engineering	Combustion and gasification, fuel spraying and modeling
prof. Martti Larmi, Aalto University, department of Mechanical Engineering	Biofuel production and combustion
prof. Risto Lahdelma, Aalto University, department of Mechanical Engineering	Energy: Modeling, simulation and optimization
Prof. Sanna Syri, Aalto University, department of Mechanical Engineering	Energy market, Societal and economic impact of energy technologies
Prof. Ville Vuorinen, Aalto University, department of Mechanical Engineering	Computational fluid dynamics, Mathematical modelling, Combustion

Degree requirements for admission process

A BSc degree corresponding to a minimum of 180 ECTS credits in the following fields: Mechanical Engineering, Chemical Engineering, Chemistry and Physics.

Applicants must document that they have fulfilled the following minimum requirements: The applicant's qualifications must include a strong working knowledge of mathematics and energy/thermal engineering. Applicants must document that they have fulfilled the following minimum requirements:

- Mathematics: 21.5 ECTS including linear algebra, calculus and differential equations
- Thermodynamics: 6 ECTS
- Mass and/or heat transfer: 6 ECTS
- Fluid mechanics: min. 5 ECTS