FMJ3121 Polygeneration Introduction 3.0 credits

Introduktion till Polygeneration

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

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FMJ3121 valid from Autumn 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

Prerequisites for being successful in this course are as follows:

- Introduction to heat transfer and thermodynamic
- Introduction to different components that are usually used in Polygeneration systems
- Working principle of the following components (at least basic knowledge): Turbine, Compressor, Generator, Chiller, Heat exchangers, Boilers, Combustor
- Being familiar with different thermodynamic cycles such as Rankin , Brayton , Stirling

These prerequisites can be defined in the frame of the following courses:

- MJ1112 Applied Thermodynamics (or equivalent).

- MJ2405 Sustainable Power Generation (or equivalent)
- MJ2490 Environomical pathways (or equivalent)
- MJ2491 Environomical Pathways, Advanced Course (or equivalent)

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing the course, students should be able to:

- In detail describe the technical concept of cogeneration of multiple energy services with flexible fuel input, specifically with regards to
- Efficiency as compared to stand-alone production
- Economical as well as environmental performance.
- Describe available technologies and engineering tools applicable in small-scale Polygeneration
- Describe and carry out engineering design of smart buffers (batteries, thermal energy storage, pure water reservoirs, etc.)
- Describe and carry out engineering design of functional control strategies for integrated polygeneration systems.

Course contents

In the Polygeneration course, cogeneration of multiple energy services (heat, power, cold, clean water…) using flexible fuel input to allow for a sustainable energy mix will be in focus. This course concentrates on small-scale Polygeneration energy system and the following sub-topics will be covered:

- Cogeneration, with focus on small-scale systems
- Available technologies and engineering tools
- Control strategies
- The integration of smart buffers: batteries, thermal energy storage, pure water reservoirs etc.
- A project task focusing on a system to be employed at specific sites
- Market potential of the Polygeneration system for small-scale rural applications

Disposition

The course is primarily a self-study course, taking advantage of pre-recorded lectures on the following topics:

- Introduction to Polygeneration + Emergency Energy Module
- MicroCHP and Prime movers for polygeneration
- Control of Polygeneration systems
- Smart (and not so smart) buffers
- Biogas, PV, Windmills
- Water treatment
- Thermally driven chilling

The knowledge from the lectures is discussed in two mandatory seminars that require preparations from the participants.

Each participant shall do a small project on Polygeneration with the base in her/his own research project. The student has the responsibility to suggest a project, which is then discussed and agreed upon with the course responsible. The project is presented at a small seminar or in the form of a poster (depending on the size of the class) and in a short project report.

Course literature

Förinspelade föreläsningar

Utdelade dokument (via Canvas)

Vetenskapliga artiklar

Pre-recorded lectures

Digital handouts (via Canvas)

Scientific papers

Equipment

Computer

Access to Canvas

Examination

- PRO1 - Project, 3.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Following all pre-recorded lectures

Actively attending >80% the seminars in the course

Competed the personal project and having presented it

Approved project report

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.