Course syllabus

Miljövänlig elproduktion Environmentally Friendly Power Generation

MVKN95, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED M
Date of Decision: 2023-04-11

General Information

Main field: Sustainable Energy Engineering.
Compulsory for: MHET1
Elective for: E4-em, F4, M4-en, M4-tt
Language of instruction: The course will be given in English

Aim

Energy demand is projected to continue its increase and this applies particularly to electricity. This means that new power generation units will need to be installed around the world at the same time as older power plants will be phased out. On top of this comes the uncertainty of nuclear power which is a controversial, both politically and economically.

Much of today's discussion on power plant production is focusing on carbon dioxide emissions and their contribution to climate change. Most of the present Swedish electricity production is characterized by very low CO2 emissions, mainly nuclear and hydro power, which means that Sweden has low carbon emissions in comparison to other countries. Globally however, coal-fired power's share of generation is still around 40% and projected to decrease 28% in 2040 (Source: IEA, WEO 2016)

The course aims at providing a deeper understanding of different types of power plant processes, their operation, environmental effects and suitability for today's power systems. Emphasis is placed on emissions of CO2, but also other environmental aspects are also considered. The covered power generation processes are: renewable (solar power, wind power, hydro and bio-fueled thermal power plants), nuclear and fossil-fired power plants with CO2 capture.

Also the effect of volatile power (solar and wind) creates problems with matching production with demand. A number of possible strategies may be invoked to overcome this such as back-up power, storage and demand side management. Further the introduction of smart grids may become a part of the solution. All these concepts are discussed in the course

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to describe the treated power plant processes and their environmental impact
- be able to describe the possibilities and limitations of renewable power generation
- be able to give a thermodynamic description of the technologies for carbon capture and their impact on plant efficiency
- be familiar with today's nuclear power plant design och thoughts on new designs
- have an in-depth knowledge in the field of the chosen essay

Competences and skills
For a passing grade the student must

- be able to do thermodynamic performance estimates of the treated power plants processes
- be able to actively participate in discussions on relevant issues for power generation
- be able to report on both potential and problems for a given power plant process, orally and in writing

Judgement and approach
For a passing grade the student must

- be able to evaluate environmental and other impact of different electricity production methods
- be able to evaluate and respond to the limitations of each power plant process

Contents

28 h lectures14 h Seminars

14 h (Scheduled) Supervision of essay

144 h self-studies

One or possibly two study visits are planned

The topics of the lectures include

- Overview of energy and electricity production and consumption in a global perspective
- Technical description of the above mentioned power production methods including environmental impact.Difficulties with introduction of volatile production methods; matching production with demand.
- Economic consequences of a transition to a low CO2 electricity production

- Projections of energy and electricity demand in the future

The seminars are of computational character and aim at giving concrete examples of possible choices an engineer may face.

Finally, the students are requested to write an essay with a topic from a given list in order to gain a deeper understanding in this sub-topic. The essay will be presented orally at seminars.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written exam and written essay to be presented orally

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0121. **Name:** Written Examination.
Credits: 5. **Grading scale:** TH. **Assessment:** Written exam.
Code: 0221. **Name:** Essay.
Credits: 2,5. **Grading scale:** TH. **Assessment:** Essay with presentation.

Admission

Assumed prior knowledge: MMVF01 Thermodynamics and Fluid Mechanics, MVKF01 Energy and the Environment in Sustainable Development or similar.
The number of participants is limited to: No
The course overlaps following course/s: MVKN25

Reading list

- Material from VGB.
- Material from research in the department (handouts).
- Articles relating to the chosen individual subject.
- Klimstra & Hottakainen "Smart Power generation".

Contact and other information

Course coordinator: Jens Klingmann, Jens.Klingmann@energy.lth.se
Examinator: Jens Klingmann, Jens.Klingmann@energy.lth.se
Course homepage: https://www.energy.lth.se/english/education/