EG2210 Electricity Market Analysis 7.5 credits

Elmarknadsanalys

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 EG2210 valid from Spring 2016

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

• SF1625 Calculus in one variable (or equivalent)

• MJ1520 Statistics and risk assessment or SF1901 Probability theory and statistics (or equivalent)

• English B/English 6 (or equivalent)

Language of instruction

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

Intended learning outcomes

The aim of the course is that the students learn methods and models for how the price is formed in an electricity market. The course comprises background information about possible ways to design an electricity market, impact from congestions, treatment of externalities such as methods to limit emissions, risk analysis and market power. Applied optimization is shown to be one suitable method to simulate market behaviour.

To pass the course, the students should show that they are able to:

- describe the principles of how an electricity market can be organised,
- describe treatment of flexible load,
- describe methods to handle congestion in power markets,
- describe methods for analyzing prices in markets with limited competition,
- describe basic methods for financial risk management in power markets,
- describe methods to handle externalities, such as environmental problems, in electricity markets,
- perform calculations of pricing in small systems with one of the above characteristics.

To receive a higher grade students should also show that they are able to:

- analyze pricing in larger power systems with combinations of several of the above named characteristics,
- apply methods for analyzing the trade off between low prices and reliability in larger power systems,
- formulate market simulation problems with mathematical expressions,
- analyze investment dynamics in electricity markets.

Course contents

- Introduction to electricity networks
  - Introduction to electric power systems
  - Introduction to microeconomics
  - Introduction to electricity markets

- Optimal dispatch
  - Efficient dispatch of electricity generation with no transmission constraints
  - Market-based dispatch of electricity generation with no transmission constraints
  - Efficient dispatch of electricity generation with transmission constraints
  - Nodal-Zonal-Regional pricing
- Managing risk
  - Basic concepts
  - Hedging with no transmission constraints
  - Introduction to electricity markets
- Market power
  - Introduction to market power
  - Market power, nodal pricing, and transmission congestion
  - Market power in wind-integrated power systems
  - Measuring, forecasting, and mitigating market power
- The generation investment decision
  - Efficient investment in electricity generation
  - Market-based investment in electricity generation
- Transmission regulation, investment, and planning
  - Introductory concepts
  - Efficient coordination of transmission and generation investment
  - Is there a role for market-based transmission investment?
  - The transmission planning problem
  - The transmission regulation problem
- Electricity Market Lab
  - Workshop on PLEXOS for Power Systems
  - A series of home projects on different electricity market issues
    - CO_2 market and Financial Markets
    - Market power and game theory

- Optimal Power Flow and Zonal/Nodal Pricing
- Hydro Power Planning
- Generation and Transmission Planning
- Transmission pricing

Disposition

The theory part of this course is run in lecture-based mode. There are some topics that students learn in project-based learning (PBL) mode. The Plexos software is used for the PBL part.

Course literature

The main literature of this course is:

(1) D. R. Biggar, M. R. Hesamzadeh, “The Economics of Electricity Markets”, IEEE-Wiley Press, August 2014

The complementary literatures are:

(2) L. Söder, “Electricity Market Analysis”, Compendium, KTH Publishing house.

(3) Reading list

Examination

- TENA - Exam, 7.5 credits, grading scale: A, B, C, D, E, FX, 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.

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.