EG2210 Electricity Market Analysis 7.5 credits

Elmarknadsanalys

Course syllabus for EG2210 valid from Spring 15

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

Grading scale: A, B, C, D, E, FX, F
Education cycle: Second cycle
Main field of study: Electrical Engineering

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 main content

- 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

  CO2 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.

Language of instruction

Language of instruction is specified in the course offering information in the course and programme directory.

Eligibility

• 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)

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

- INL1 - Home Assignment, 1.5 credits, grading scale: P, F
- KON1 - Written Test, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Requirements for final grade

Passed written exam.