Electricity Market Analysis

Syllabus
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Lecturer and Examiner:
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References:

(1) Textbooks:

- D. R. Biggar, M. R. Hesamzadeh, The Economics of Electricity Markets, IEEE-Wiley, August 2004. (Textbook A)
  Chapters: 1, 2, 3, 4, 5, 6, 7, 9, 10, 13, 14, 15, 16, 17, 18
- M. R. Hesamzadeh, J. Rosellón, I. Vogelsang, Transmission Network Investment in Liberalized Power Markets. Springer International Publishing, September 2020. (Textbook B)
  Chapters: Starting at pages 275, 323, 353

(2) Lecture notes:
My lecture notes will be provided to the students.

Course description:
The aim of this course is to provide a fundamental understanding about the theory of liberalized electricity markets. The course first reviews essential concepts in micro-economics. Market structure for electricity industry is then explained. Achieving the efficient short-term operation of the electricity industry using a market mechanism is theoretically discussed and important market design insights are derived. Nodal pricing resulting from representing network constraints is explained and its fundamental equations are derived. Conditions for obtaining efficient generation and consumption investments in a market environment are analytically discussed. The course also teaches the standard hedge market contracts that market participants can use to hedge their profit or net-utility against inter-temporal and inter-locational price risks. The concept of market power both in theory and practice will be discussed. The theory of transmission investment and the related concepts of incentive regulation will be discussed in the course.

Level: MSc students: EG2210 (7.5 credits)
PhD students: FEG3222 (10 credits) or FEG322&FEG3322 (15 credits)

Assessment:
EG2210 (7.5 credits):
Project: 20%
Final exam: 80%

Project: A topic related to the course contents will be selected by the student. The student writes a report around the topic in a specific format provided to the students and then present his/her work for the class. One the reports are collected; a time will be allocated to each student to present his/her work for other students in the course.

Final Exam is written and is given twice a year. To attend the exam, it is required to register in advance using KTH My pages, which can be accessed from the student web site. To pass the course, it is necessary to score at least 50 points out of 100. Students who have failed the course but are close to the requirement for passing (i.e., 45-49 points) may write a supplementary test. If the result of this test is approved, the student will get the grade E. The date of the extra test is decided by the course examiner after consulting with the concerned students. However, the student must notify his or her intention to write the supplementary test no later than one month after the exam.

The following aids are allowed at the exams and extra tests:

- Calculator without information relevant to the course.
- One handwritten, single-sided A4-page with your own notes (original, not a copy), which should be handed in together with the exam.

The final grade is calculated based on the following table.

Final mark	Garde
91-100	A
81-90	B
71-80	C
61-70	D
50-60	E
45-49	Fx
0-44	F

FEG322 (10 credits):
The PhD student passes the EG2210 and then submits a conference paper. The topic of the conference paper is decided based on the meeting discussion with the lecturer.

FEG322&FEG3322 (15 credits)
The PhD student passes the EG2210 and then submits a journal paper. The topic of the journal paper is decided based on the meeting discussion with the lecturer.

Intended Learning Outcomes (ILOs)

After passing the course, the student should be able to:

- Describe the electricity industry restructuring process from a vertically-integrated-utility (VIU) design to a liberalized market-based design,
- Understand the theory behind the economic-dispatch model and its auction mechanism,
- Analyze the impact of power-system constraints (and in particular network constraints) on the electricity prices obtained through an economic dispatch model,
- Use the standard hedge market contracts for price risk management,
- Apply the theory of market power to analyze electricity markets,
- Use the theory of transmission and generation investment for expanding the electricity industry.

Preliminary topics:

The preliminary topics planned for the course include:

- Introduction to micro-economics
- Electricity industry market structure and competition
- Efficient short-term operation of an electricity industry
- Efficient investment in generation and consumption assets
- Managing intertemporal price risk
- Managing inter-locational price risk
- Market power in electricity markets
- Efficient investment in network assets and incentive mechanism
- Regression analysis and forecasting (If time allows.)

For a detailed list of topics, please see the table of contents of the two textbooks (Textbook A and B) introduced as the references for this course.