

Energy Market Modeling

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Course contents

Energy markets are undergoing fundamental changes, and numerical models can be used to analyze the potential impact of these changes on market outcomes. For this reason, energy market models are widely used to inform private firms and policymakers as well as to conduct research in academia.

This course focuses on the fundamental modeling of electricity markets, which play a central role in the energy sector already today and even more so in the future. We start with an introduction to the General Algebraic Modeling Software (GAMS). On this basis, we model:

- 1) Power plant dispatch
- 2) Power plant investment
- 3) Storage dispatch and investment
- 4) Electricity trade

To address these different aspects, this course provides you with a step-by-step guide to building your own stylized partial equilibrium model of the electricity market: first, we develop a basic understanding of how electricity markets work; second, we formalize market mechanisms into mathematical equations; third, we implement these equations in software code; fourth, we interpret the results and discuss model limitations.

The course sessions will be complemented by guest lectures on how energy market models are used in academia and in the energy industry. In addition, we offer an (optional) field trip to the combined heat and power plant “[Heizkraftwerk Niehl](#)” of the energy supplier RheinEnergie (limited seats will be allocated at the beginning of the course).

At the end of the course, students should form groups to (further) develop an energy market model and apply it to a case study of their choice. The results should be presented in class and submitted as a short report.

Please refer to the second page of this syllabus for a detailed overview of topics and sessions.

Course organization

Class hours & venues:

- Fridays, 09:00 – 12:00
- 827 Seminarraum (KFR1), Alte Wagenfabrik, Vogelsanger Str. 321a

The **field trip** takes place on Friday, 24 Oct 25, 09:30 – 12:30.

Office hours are offered on request.

Please **register for this course** via KLIPS (1st and 2nd registration period).

Prior or parallel participation in the course “Energy Markets and Regulation” is recommended but not required (course contents and schedules are designed to match well).

This course features a **combined examination**:

- Presentation (30% of points)
- Report (70% of points)

The project should be conducted in groups of 2-3 students. The presentation should be 16–24 minutes long (8 minutes per student). The report should comprise about 2,500 words.

Further information and course material will be distributed via the **ILIAS platform**.

For **questions**, please do not hesitate to reach out:

- On content, please contact Maximilian Walde (walde_maximilian@wiso.uni-koeln.de)
- On administration, please contact Monika Räthe (monika.raethe@uni-koeln.de)

Course schedule

The following schedule is tentative. Potential changes would be communicated via ILIAS.

Date	Type	Topic
17 Oct 25	Session 1	Intro to the course, optimization, and GAMS
24 Oct 25	Field trip	Visit of “Heizkraftwerk Niehl”
31 Oct 25	Session 2	Modeling power plant dispatch
14 Nov 25	Session 3	Modeling power plant investment Guest lecture: models in academia (EWI)
28 Nov 25	Session 4	Modeling storage Guest lecture: models in the industry (Trianel)
By 05 Dec 25, 23:59	Deadline	Register for the examination
12 Dec 25	Session 5	Modeling trade Project Kick-Off
19 Dec 25	Buffer	
By 22 Dec 25, 23:59	Deadline	Withdraw from the examination
23 Dec 25 – 6 Jan 26	Winter break	
09 Jan 26	Session 6	Individual project check-ins
30 Jan 26	Session 7	Project presentations
By 28 Feb 26, 23:59	Deadline	Project report submission (examination date)