

Energy Markets and Economics

SYLLABUS

Course overview (academic year 2021/2022)

This course covers a variety of theoretical and empirical topics related to the economics of the power sector.¹ This includes concepts such as supply and demand for power, the structure of the industry (generation, transmission and distribution, retail supply), economic regulation of the power sector, wholesale power markets and their design (including competition issues), energy efficiency and retail supply, among other topics.

The core objective of this course is to gain a good understanding of the power sector with a focus not only on theoretical concepts but also on a more practical application of economic concepts related to power markets.

Course outline:

1. Introduction to the economics of the power sector (supply and demand for power, structure of the industry – generation, transmission and distribution, retail supply);
2. Possible models for organising the power sector, technical characteristics that affect that choice and sector liberalisation;
3. Need for economic regulation and current approaches to regulation and related concepts (cost plus or rate of return, price cap vs revenue cap, RIIO, RAB, etc.);
4. Wholesale electricity trade, including energy only markets and capacity markets, and competition issues;
5. Investment decision making in generation and transmission;
6. CO2 emissions, overview of decarbonisation policy instruments, EU ETS;
7. Renewables and energy efficiency measures; and
8. Retail supply, retail competition and retail pricing (including concepts of long run and short run marginal costs, average costs and market failures related to information).

¹ Except where the context implies we use the terms “power” and “electricity” interchangeably, e.g. “power sector” and “electricity sector” are the same.

Learning outcomes

The aim of this course is to achieve a good understanding of basic concepts and tools related to the power sector and power markets. The focus will be not only on acquiring basic theoretical knowledge underpinning power markets, but also on the practical application of theory to the real world power sector. After successful accomplishment of this course, students will have gained an understanding of the power sector and how it is organised, an understanding of economic issues underpinning power markets and an understanding of policy instruments that can be used to meet Government objectives for the sector.

Requirements

The course is designed for both undergraduate and graduate students. Nevertheless, it is necessary to have good background knowledge in microeconomics as well as quantitative skills to successfully pass this course.

The final grade is based on a written empirical paper (term paper) and performance during the final exam, with the following weights:

- Written empirical paper (40%); and
- Final written exam (60%).

Moreover, you are required to get at least 50% in your final exam in order to successfully pass the course.

Grading

We follow the [Dean's measure No. 17/2018](#) and the stipulated rules for the A-F grading using rounding up to the nearest whole percentage:

- 91% and above => A
- 81-90 % => B
- 71-80 % => C
- 61-70 % => D
- 51-60 % => E
- 0-50 % => F

For example, a total result of 90.5% (combining the results for the empirical paper and final exam) corresponds to grade A and a total result of 50.5% corresponds to grade E. This also means that you'll have to get at least 50.5% to successfully pass the course.

The A-F grading shall be interpreted as follows (lecturer's translation from the Czech version):

- A – Excellent (excellent performance with only minor errors);
- B – Very good (above average performance, but with some errors);
- C – Good (overall good performance with a number of significant errors);

- D – Satisfactory (acceptable performance but with considerable shortcomings);
- E – Sufficient (performance meets minimum requirements);
- F – Insufficient, fail (a considerable amount of additional work is needed).

Term paper

In this course you are required to write an empirical (term) paper, which counts for 40% of your total mark for the course. The term paper consists of two tasks:

- Describing the power sector in a country of your choice (Task 1: 70% of the grade for the term paper); and
- Solving a set of computational exercises that relate to the topics discussed during the lectures (Task 2: 30% of the grade for the term paper).

For this term paper we ask that you form teams of between two and four people. We encourage you to find team members yourself but if anyone has difficulty, we are here to assist you to find suitable teammates.

Literature

There is no single textbook for this course and for this reason we try to include a lot of information in the course material discussed during the lectures. Nevertheless, there are several good books from which you can read selected chapters that link well to the topics covered in this course:

- Power: A Practical Handbook, Danielle Beggs and Rajan Phakey, SNR Denton, Globe Law and Business, 2017, ISBN: 978-1905783854, 251 pages, available in the IES library. Nick Elms authored a chapter of this book.
- The Economics of Electricity Markets, Barry R. Biggar, Wiley – IEEE, 1st Edition, September 2014, ISBN: 978-1118775752, 432 pages, available in the IES library.
- Making competition work in electricity, Sally Hunt, Wiley, 2002, ISBN: 978-0-471-22098-5, available online ([link](#)).
- Steven Stoft, Power system economics: designing markets for electricity, 2002, ISBN: 978-0-471-15040-4, 496 pages (part of the book available online - [link](#)).

A BRIEF DESCRIPTION OF THE TOPICS:

Lecture 1: Introduction to the economics of energy and power markets

The aim is to provide an overview of the power sector and how it is organised, as well as an understanding of basic technical and economic concepts related to energy supply and demand. We will cover the following topics:

- The importance of energy and power to the economy;
- Power sector value chain:
 - Acquisition of primary energy and power generation;
 - Conventional generation;
 - Renewable generation;
 - Electricity networks (transmission and distribution);
 - Retail markets and electricity demand.

Lecture 2: Organisation of the power sector

The typical structure of the power market has evolved over time. The aim is to give an overview of the different ways in which the power sector is organised and the economics driving the choice of organisation.

- Different models for organising the power market
- Organisation of transmission and distribution network businesses
- Technical and economic characteristics of the sector and implications for organising the wholesale and retail markets
- Brief history of power sector deregulation and how this relates to power markets today
- Factors driving power sector reforms, e.g. country policy objectives etc

Lecture 3: Need for economic regulation and current approaches to regulation and related concepts (cost plus or rate of return, price cap, RIIIO, RAB, etc.)

- Why regulate – trade-off between regulation and competition
 - Market failures
 - Cost of regulation
- Objectives of regulation
 - Achieving allocative and productive efficiency
 - What to regulate
- How to regulate
 - Ex-ante vs ex-post regulation
 - Incentives (cost plus, rate of return, yardstick)

- Setting allowed revenues.

Lecture 4: Wholesale electricity trade, including energy only markets, and capacity markets

- Technical and economic issues that affect the organisation of wholesale trade
 - Re-cap
- Organisation of wholesale trading, including output decisions and pricing
 - Power pool
 - Balancing group model
- Real world market outcomes
- Competition issues

Lecture 5: Investment decision making

- Generation
 - Energy only markets
 - Energy markets with a capacity mechanism
- Transmission
- Investment under uncertainty

Lecture 6: Climate change, decarbonisation and EU ETS

- Climate change and emissions targets
 - CO₂ abatement costs
 - Social cost of CO₂
- Overview of policy instruments for decarbonisation
 - Need for intervention (market failure)
 - Types of intervention
- EU ETS and its effect on power market outcomes
 - Overview of EU ETS as a cap and trade mechanism
 - Effect on power market operations and investment decision making

- Interaction between the EU ETS and other decarbonisation policy instruments

Lecture 7: Renewables and energy efficiency measures

- Renewable energy and its potential
 - Why support renewable generation
 - Form of renewable support mechanisms
 - Intermittency of renewable energy sources
 - Pricing of energy from renewable energy sources
- Energy efficiency as a cost-effective way to reduce energy use and emissions
 - Benefits associated with energy efficiency goes beyond avoiding climate change (improving security of supply, fighting fuel poverty)
 - Ways to improve energy efficiency and energy efficiency policies
 - Energy efficiency and market failures.

Lecture 8: Retail supply, retail competition and pricing

- Role of retail markets
 - Retailers and their 'added value' in the value chain (buying power, offering a range of complementary products – metering, real time pricing)
 - Experience with retail competition in the EU
- How retail markets work
 - Competitive retail markets
 - Tariff structure
 - Load profiles
 - Back-up suppliers
 - Setting tariffs in non-competitive retail markets
- Demand side response
- Retail market failures

COURSE SCHEDULE

In total there are eight lectures (no seminars). Due to ongoing travel restrictions, we have chosen a combination of online and in person lectures. The intended

schedule for this year is as follows (subject to change depending on the travel as our lecturers are not based in the Czech Republic):

- 1st lecture (online): Friday 1st October (12:30 - 13:50)
- 2nd lecture (online): Friday 8th October (12:30 - 13:50)
- 3rd lecture (online): Friday 22nd October (12:30 - 13:50)
- **4th lecture (in person): Friday 5th November (12:30 - 13:50)**
- **5th lecture (in person): Friday 5th November (14:00 - 15:20)**
- **6th lecture (in person): Friday 19th November (12:30 - 13:50)**
- **7th lecture (in person): Friday 19th November (14:00 - 15:20)**
- 8th lecture (online): Friday 26th November (12:30 - 13:50)

Please note that while we will try to maintain these dates, the dates of the lectures might change. Please also note that there are two lectures on Friday 5th November and Friday 19th of November (i.e. we have two block lectures that will be delivered in person. In addition, if the epidemiological situation and the accompanying restrictions evolve in a way that teaching in person is not possible, we will move all lectures to an online platform (MS Teams).

EXAM

Please note that there will be three exam terms, which means everyone will have up to three attempts to sit and pass the exam.

CONTACTS

If you have any query regarding this course, your obligations, the exam or are unsure about how electricity markets really work, please drop Nick and I an email:

- Petra Valickova, teacher: petra.valickova@outlook.com
- Nick Elms, teacher: nick.d.elms@outlook.com

You can also drop an email to our teaching assistants regarding the term paper:

- Vojtěch Mišák, teaching assistant: misakvojtech93@gmail.com
- Levan Bezhanishvili, teaching assistant: levan.bezhanishvili@cerge-ei.cz