

31761 - Renewables in Electricity Markets

Contents and Schedule

Over Spring 2017, lectures will be given in 341, aud. 21, while the exercise sessions will take place in 325, databars IT017 and IT025. For the game to be played on 20 February 2017, the location will be Glassalen (101).

The course sessions are scheduled on Monday afternoon, 1-5pm.

List of Lectures

The course relies on the following set of lectures:

- Lecture 0:** *“Renewables in electricity markets – Introduction”*
Pierre Pinson, DTU Elektro
- Lecture 1:** *“Fundamentals of electricity markets – Organization, history and basics”*
Pierre Pinson, DTU Elektro
- Lecture 2:** *“Day-ahead electricity markets”*
Pierre Pinson, DTU Elektro
- Lecture 3:** *“Regulatory aspects of electricity markets with renewables”*
Klaus Skytte et al., DTU Management Engineering
- Lecture 4:** *“Ancillary services and regulation markets”*
Pierre Pinson, DTU Elektro
- Lecture 5:** *“Intra-day and balancing markets”*
Pierre Pinson, DTU Elektro
- Lecture 6:** *“Participation of renewables in electricity markets”*
Pierre Pinson, DTU Elektro
- Lecture 7:** *“Gaming aspects of electricity market participation”*
Tue V. Jensen, DTU Elektro
- Lecture 8:** *“Impact of renewables on electricity markets”*
Pierre Pinson, DTU Elektro
- Lecture 9:** *“Basics of renewable energy analytics”*
Pierre Pinson, DTU Elektro
- Lecture 10:** *“Forecast verification”*
Pierre Pinson, DTU Elektro
- Lecture 11:** *“Renewable energy modelling and forecasting”*
Pierre Pinson, DTU Elektro
- Lecture 12, etc.:** *“Sneak preview on current challenges with renewables in electricity markets”*
Guests from DTU Management, DTU Compute, DTU Elektro

Exercise sessions

In order to accommodate the concepts discussed in the various lectures, the following exercise sessions are planned:

- Exercise session 1:** *“Day ahead electricity markets”*
- Exercise session 2:** *“Ancillary service markets”*
- Exercise session 3:** *“Intra-day and balancing markets”*
- Exercise session 4:** *“Market participation for renewables”*
- Exercise session 5:** *“Verification of renewable energy forecasts”*

- Exercise session (optional):** *“Gaming in electricity markets”*

For each and every exercise session, a correction session (30-45mins) is planned for discussion.

Assignments

The course and its evaluation rely on 4 assignments:

- Assignment 0:** How would you design an electricity market?
- Assignment 1:** Build and operate a realistic day-ahead electricity market!
- Assignment 2:** Participation and revenue optimization for a renewable energy producer in the electricity market
- Assignment 3:** Renewable energy forecasting – Lets compete!

Assignments 1-3 will count for 30% of the final grade. They are to be performed over a period of 3-4 weeks. Group work is preferred. A group should ideally be composed of 2 students, but groups of 3 will also be accepted. **Respective contribution must be stated in the assignment reports.**

In parallel, Assignment 0 will count for 10% of the final grade. It is an individual assignment which may be delivered at any time between 30.1.2017 and 8.5.2017.

Detailed schedule

Here is the detailed schedule for Spring 2017:

Day 1 (30.1.2017):

Lecture 0 (45mins) - *“Renewables in electricity markets – Introduction”*

Lecture 1 (60mins) - *“Fundamentals of electricity markets – Organization, history and basics”*

Prospective session: *How would you design an electricity market (accounting for the fact it has a significant share of renewables)?*

Day 2 (6.2.2017):

Lecture 2 (1h45) - *“Day-ahead electricity markets”*

Exercise session 1 (2h) - *“Day-ahead electricity markets”*

Presentation of 1st assignment

Day 3 (13.2.2017):

Lecture 3 (1h45)- *“Regulatory aspects of electricity markets with renewables”*

Exercise session 1: correction and discussion (30mns)

Assignment time (1h30)

Day 4 (20.2.2017):

Playing the electricity market game! (3h, Glassalen)

Day 5 (27.2.2017):

Lecture 4 (1h) - *“Ancillary services and regulation markets”*

Exercise session 2 (1h15) - *“Ancillary service markets”*

Assignment time (1h30) – *[first assignment to be delivered on 5.3.2017]*

Day 6 (6.3.2017):

Lecture 5 (1h30) - *“Intra-day and balancing markets”*

Exercise session 2: correction and discussion (30mns)

Exercise session 3 (2h): *“Intra-day and balancing markets”*

Day 7 (13.3.2017):

Lecture 6 (1h30) - *“Participation of renewables in electricity markets”*

Exercise session 3: correction and discussion (30mns)

Exercise session 4 (1h30): *“Market participation for renewables”*

Presentation of 2nd assignment

Day 8 (20.3.2017):

Lecture 7 (2h) - *“Gaming aspects of electricity market participation”*

Exercise session 4: correction and discussion (30mins)

Assignment time (1h30)

Day 9 (27.3.2017):

Lecture 8 (1h15) - *“Impact of renewables on electricity markets”*

Assignment time (2h30) - *[second assignment delivery on 2.4.2017]*

Day 10 (3.4.2017):

Lecture 9 (1h30) - *“Basics of renewable energy analytics”*

Presentation of 3rd assignment

Assignment time (2h)

Day 11 (24.4.2017):

Lecture 10 (1h15) - *“Forecast verification”*

Exercise session 5 (1h30) - *“Verification of renewable energy forecasts”*

Assignment time (1h)

Day 12 (1.5.2017):

Lecture 11 (1h15) - *“Renewable energy modelling and forecasting”*

Exercise session 5: correction and discussion (30mins)

Assignment time (2h)

Day 13 (8.5.2017):

Lecture 12, 13 and 14: sneak preview into research on renewables and markets (2h)

Assignment time (2h) - *[third assignment delivery before 15.5.2017]*