

# 31761 - Renewables in Electricity Markets

## Contents and Schedule

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Over Spring 2018, lectures will be given in building 341, aud. 21, while the exercise sessions will take place in building 325, databars IT017 and IT025. For the game to be played on 19 February 2018, the location will be Glassalen (in building 101).

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

### List of Lectures

The course relies on the following set of lectures:

<b>Intro.:</b>	<i>“Renewables in electricity markets – Introduction”</i> Pierre Pinson, DTU Elektro
<b>Lecture 0:</b>	<i>“Fundamentals of electricity markets – Organization, history and basics”</i> Pierre Pinson, DTU Elektro
<b>Lecture 1:</b>	<i>“Day-ahead electricity markets”</i> Pierre Pinson, DTU Elektro
<b>Lecture 2:</b>	<i>“Intra-day and balancing markets”</i> Pierre Pinson, DTU Elektro
<b>Lecture 3:</b>	<i>“Regulatory aspects of electricity markets with renewables”</i> Lena Kitzing, DTU Management Engineering
<b>Lecture 4:</b>	<i>“Ancillary services and regulation markets”</i> Pierre Pinson, DTU Elektro
<b>Lecture 5:</b>	<i>“Participation of renewables in electricity markets”</i> Pierre Pinson, DTU Elektro
<b>Lecture 6:</b>	<i>“Gaming aspects of electricity market participation”</i> Tue V. Jensen, DTU Elektro
<b>Lecture 7:</b>	<i>“Impact of renewables on electricity markets”</i> Pierre Pinson, DTU Elektro
<b>Lecture 8:</b>	<i>“Basics of renewable energy analytics”</i> Pierre Pinson, DTU Elektro
<b>Lecture 9:</b>	<i>“Forecast verification”</i> Pierre Pinson, DTU Elektro
<b>Lecture 10:</b>	<i>“Renewable energy modelling and forecasting”</i> Pierre Pinson, DTU Elektro
<b>Lecture 11:</b>	<i>“Renewable energy modelling and forecasting”</i> Pierre Pinson, DTU Elektro
<b>Lecture 12:</b>	<i>“Let’s go peer-to-peer”</i> Pierre Pinson, DTU Elektro

### Exercise sessions

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

<b>Exercise session 1:</b>	<i>“Day ahead electricity markets”</i>
<b>Exercise session 2:</b>	<i>“Intra-day and balancing markets”</i>
<b>Exercise session 3:</b>	<i>“Ancillary service markets”</i>
<b>Exercise session 4:</b>	<i>“Market participation for renewables”</i>
<b>Exercise session 5:</b>	<i>“Verification of renewable energy forecasts”</i>
<b>Exercise session (optional):</b>	<i>“Gaming in electricity markets”</i>

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

## Assignments

The course and its evaluation rely on 3 assignments:

- 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 33% 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.**

## Detailed schedule

Here is the detailed schedule for Spring 2018:

### **Prior to Day 1 (i.e. preparatory homework, prior to 29.1.2018):**

Lecture 0 - *“Fundamentals of electricity markets – Organization, history and basics”*

### **Day 1 (29.1.2018):**

Intro. session (30mins) - *“Renewables in electricity markets – Introduction”*

Prospective session (30mins) - *“Lecture 0 – getting the basics right”*

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

### **Day 2 (5.2.2018):**

Lecture 2 (1h45) - *“Intra-day and balancing markets”*

Exercise session 1 (1h30) - *“Day-ahead electricity markets”*

*Presentation of 1st assignment*

### **Day 3 (12.2.2018):**

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

Exercise session 1: correction and discussion (30mins)

Assignment time (1h30)

### **Day 4 (19.2.2018):**

Playing the electricity market game! (4h, Glassalen)

### **Day 5 (26.2.2018):**

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

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

Assignment time (1h) – *[first assignment to be delivered on 4.3.2018]*

### **Day 6 (5.3.2018):**

Lecture 5 (1h45) - *“Participation of renewables in electricity markets”*

Exercise session 2: correction and discussion (30mins)

Exercise session 3 (1h15): *“Ancillary services and regulation markets”*

*Presentation of 2nd assignment*

### **Day 7 (12.3.2018):**

Lecture 6 (1h45) - *“Gaming aspects of electricity market participation”*

Exercise session 3: correction and discussion (30mins)

Exercise session 4 (1h15): *“Market participation for renewables”*  
Assignment time (30mins)

**Day 8 (19.3.2018):**

Lecture 7 (1h15) - *“Experiencing the whole electricity market chain”*  
Exercise session 4: correction and discussion (30mins)  
Assignment time (2h)

**Day 9 (9.4.2018):**

Lecture 8 (1h30) - *“Basics of renewable energy analytics”*  
Assignment time (2h) - [second assignment delivery on 15.4.2018]

**Day 10 (16.4.2018):**

Lecture 9 (1h30) - *“Forecast verification”*  
Exercise session 5 (1h30) - *“Verification of renewable energy forecasts”*  
*Presentation of 3rd assignment*  
Assignment time (1h)

**Day 11 (23.4.2018):**

Lecture 10 (1h15) - *“Renewable energy modelling and forecasting I”*  
Exercise session 5: correction and discussion (30mins)  
Assignment time (2h)

**Day 12 (30.4.2018):**

Lecture 11 (1h15) - *“Renewable energy modelling and forecasting II”*  
Assignment time (2h30)

**Day 13 (7.5.2018):**

Lecture 12 (1h15) - *“Consumer-centric electricity markets”*  
Assignment time (2h30) - [third assignment delivery before 14.5.2018]