

# 31761 - Renewables in Electricity Markets

## Assignment 2: Expectations

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### General considerations

Assignment 2 concentrates on participation in electricity markets with a portfolio of renewable energy generation. This portfolio actually consists of a single wind farm located in Western Denmark. Assignment 2 requires knowledge of both basic market concepts (day-ahead and balancing stages) and market participation aspects following the lectures, exercise sessions, games and reading material from the first 8 weeks of the course. The work to undertake involves a bit of mathematical modelling, implementation, generation and discussion of results, as well as presentation of the work in a short report.

The aim of Assignment 2 is to evaluate

- your understanding of combined day-ahead and balancing markets,
- your ability to use forecasts as input to decision-making,
- your understanding of market revenues and their potential improvement,
- your ability to use real-world data as input,
- your critical analysis of the results generated.

I should add that the aim is additionally to evaluate your ability to master the concepts of the course and to use those to develop new insights into the workings of day-ahead electricity markets through an application to a realistic test case. In parallel, the aim is also to have you develop your ability to deliver and discuss the outcome of your work in a synthetic manner. The constraint of 10 pages on the report is there to force you to prioritize the material and sorting what is most important and what can be placed in Appendices (or simply skipped).

In addition, my main objective with this second assignment is to get you to have an overall understanding of the timeline of electricity markets (days-ahead and balancing) while being able to handle substantial amounts of data. This assignment represents more work than the first one, and leaves a lot of room for you to do the minimum by trying very simple strategies or to push hard by trying to do more advanced optimization and modelling to propose more efficient strategies. Since getting feedback after Assignment 1, I also expect that the assignment reports are better constructed and presented.

### What makes the grade?

In terms of the assignment grading itself, the philosophy is to grade between 0 and 100 (you could think of percentage of success), where the minimum passing percentage is somewhere between 30 and 40%. I keep it as an adjusting parameter based on the performance of the class overall that year. This is in line with the Danish way of grading where nearly all grades are a pass (i.e., 0 is a fail, but {2,4,7,10,12} are passing grades). Eventually, the grades for quizzes and assignments will be taken all together, and a final grade in the Danish grading scale will be generated.

### Grading blocks for this assignment

The various topics graded in Assignment 2 include (with the number of points assigned for each part between parentheses):

*Formulation of revenues* (15 points): the students should be able to describe what makes the revenues, by having a clear view of its various components, balancing prices depending on system state and individual imbalance, etc.

*Formulation of strategies* (12 points): the students should be able to present the 3 types of strategies they had to work with, as well as some of the basic aspects of the timeline for market participation

*Rigour and creativity of strategies* (25 points): the students should be able to propose basic types of strategies (in each category) and to develop ideas to make them more advanced, through optimization of a few parameters and learning from the data. All proposals should be well motivated(!)

*Revenue calculation* (10 points): this is the way we can see if the ideas have implemented correctly, while the data is also used correctly

*Analysis of strategies and revenues* (22 points): the students should be able to go beyond the technical aspects of programming and plugging data in their machinery to develop some key insights about the strategies, i.e., comparing strategies 1, 2 and 3, and the potential benefits of proposing more advanced versions of these strategies

*Code* (5 points): there the code that is used to produced the results is verified to ensure that is reflects the formulation proposed, and can plausibly produce those results

*Report quality* (10 points): the students should be able to prioritize the material to be presented in the report, make proper use of the English language, make right choices of illustrations, etc.

The total number of points is hence 100.