DTU Technical University of Denmark

46750 - Optimization in Modern Energy Systems
Exercise 7

Name:

Student Number:

1. Optimal offering strategy of price-taker wind producer

We consider a **price-taker** wind producer (W_1) which aims at maximizing its own expected profit in the day-ahead electricity market and balancing market. Its marginal production cost is $c^G_{W_1} = 15 EUR/MWh$. Before deciding on the production to offer in the day-ahead market, the day-head λ^{DA} and balancing λ^B market prices, and the available wind production $\overline{P}_{W_1}$ are still uncertain. Once its production offered to the day-ahead market has been decided, and all sources of uncertainty have been revealed, the wind producer must settle any remaining imbalance. We consider that the wind producer only has access to (independent) forecasts of the realizations of the day-ahead and balancing prices and available wind production, such that:

- $\lambda^{DA} = 20 EUR/MWh$ with a probability 1 (perfectly known for simplicity)
- $\lambda^B = 15 EUR/MWh$ with a probability 0.5 or $\lambda = 35 EUR/MWh$ with a probability 0.5
- $\overline{P}_{W_1} = 125 MWh$ with a probability 0.5 or $\overline{P}_{W_1} = 75 EUR/MWh$ with a probability 0.5

(a) When are the decisions of the wind producer made, compared to the realization of the uncertain parameters. Can they be changed afterwards? How many stages of decisions are there?

(b) Formulate and solve the optimal offering strategy problem of the wind producer with a one-price balancing scheme. Report and analyse the most relevant results.

(c) Formulate and solve the optimal offering strategy problem of the wind producer with a two-price balancing scheme. Report and analyse the most relevant results, and compare them to the one-price scheme.

(d) Compute the expected value of perfect information (EVPI) for this optimization problem with the one- and two-price balancing schemes.