Effect from imperfect information in different electricity market

Mid-term Presentation

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Outline

Basic Facts

- In the electricity market, companies have to make decisions based on prediction of electricity demand and price
- No prediction is perfect. Companies will have to deal with imperfect information

Different Kinds of Decision Making in Electricity Market

- Operations planning
  - Unit commitment
  - Maintenance and production scheduling
- Real time operations:
  - Dispatch
  - Automatic protection

Purpose

- Purpose of this project is to find out how prediction accuracy affect companies' behavior and benefit in the electricity market.

Model Assumptions

- Linearity
- Error distribution

Scenarios

There are two scenarios to be discussed in the project:

- Single firm model
- Competitive market/optimal bidding model

Approach

- For the single firm scenario, the problem will be set as a linear optimization problem with single objective function; a software solver such as excel solver or matlab will be used to solve the problem.
- For the optimal bidding scenario.the problem will be maximize the expected profit by hand.

Single Firm Scenario

- Market(competitor)
- Demand
- Price
- Utility

Single Firm Scenario

Objective:

- Minimize operation cost

Decision variables:

- Which unit/units to be used for the moment
- What kind of fuel or technology to generate from for the particular moment

Single Firm Scenario

Constraints:

- Capacity
- Demand
- Environmental regulations
- Ramp
- Reserved capacity

Optimal Bidding Scenario

- Market(competitor)
- Demand
- Price
- Bidding System

Optimal Bidding Scenario

Objective:

- Maximize expected profit

Decision variables:

- Bid quantity
- Bid price

Information:

- Prediction of price
- Error distribution of prediction
- Effective demand curve (optional)

Optimal Bidding Scenario

Constraint:

- Bidding cap

Different situation:

- No market power
  - Market clearing price system
  - Pay as bid
- With elastic demand

Project Output

The following outputs are expected from this project:

- List of economics results under different scenarios of different prediction accuracy,
- Mathematical description of market models, including data and equations,
- Spreadsheet of Excel showing details of how the model is structured and solved,
- Technical report and presentations summarizing the work.

Reference I


E. Bender.
An Introduction to Mathmetical Modeling.
Dover Publication, 1978.


B. Hobbs.
Regulating Regional Power Systems.
Quorum Books, 1995.


Paul L. Joskow.
Markets for power in the united states: An interim assessment.
The Energy Journal, 27(1):1–35, 2006.


E. McGarity.
Design and Operation of Civil and Environmental Engineering Systems.
John Wiley and Sons, Inc., 1997.

Reference II


J. Miller.
The Chicago Guide to Writing about Multivariate Analysis.
The University of Chicago Press, 2005.