



Open-access tools for the modelling and simulation of electricity markets

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Summary

Globally, renewable energy generation is increasing, raising the complexity of operating electrical grids to maintain stability and balance. This highlights the need for developing electricity market (EM) models fitting this new reality. To test, study, and validate the possible effects of novel EM designs, simulation techniques are frequently employed. This work proposes the use of two open-access tools for the modeling and simulation of complex EMs. EMS enables the simulation of two commonly used auction-based algorithms and the execution of three European wholesale EMs. The Spine Toolbox is an open-source software for complex energy systems modeling. Combining them allows the modeling and simulation of complex EMs from the wholesale to local markets, as well as testing and validating new market designs. This work's case study demonstrates how to use these tools to simulate the operation of the Iberian EM – MIBEL – for a month, using public data available from the market operator's website. The results are analyzed from the perspective of the market operator and two players, i.e., a selected buyer and seller, for a specific day and the whole month.

Highlights

- This work proposes the use of the Electricity Markets Service for EMs simulation, in tandem with the Spine Toolbox for complex energy systems modeling.
- A demonstration is made on how to automate the simulation of the Iberian Electricity Market for a month using real bids' data gathered from the Iberian market operator.
- From the market operator's standpoint, the results represent the overall session outcomes, the market's social welfare and, the monthly results overview. Regarding each player, the results are seen individually according to his outcomes in each trading session.
- The simulation of the Iberian Electricity Market for February 2019, using real data collected from OMIE's file repository was demonstrated, showing EMS as a proven effective tool for EMs simulation in terms of its scalability and ability to handle large amounts of data.



The TradeRES project will develop and test innovative electricity market designs that can meet society's needs of a (near) 100% renewable power system. The market design will be tested in a sophisticated simulation environment in which real-world characteristics such as actors' limited foresight into the future and risk aversion are included.



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