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New Markets Design & Models for 100% Renewable Power Systems

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Simulation tools for electricity markets considering power flow analysis

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Summary

The share of renewable generation is growing worldwide, increasing the complexity of the grids operation to maintain its stability and balance. This leads to an increased need for designing new electricity markets (EMs) suited to this new reality. Simulation tools are widely used to experiment and analyze the potential impacts of new solutions, such as novel EM designs and power flow analysis and validation. This work introduces two web services for EMs' simulation and study, in addition to power flow evaluation and validation, namely the Electricity Market Service (EMS) and Power Flow Service (PFS). EMS enables the simulation of two auction-based algorithms and the execution of three wholesale EMs. PFS creates and evaluates electrical grids from the transmission to distribution grids. Being published as web services facilitates their integration with other services, systems, or software agents. Combining them allows for the simulation of EMs from wholesale to local markets and testing if the results are compatible with a specific grid. This article presents a detailed description of each service and a case study of an electricity trading community participating in the MIBEL day-ahead market through an aggregator to reduce their energy bills. The results demonstrate the accuracy and usefulness of the proposed services.

Highlights

- Two web services for Electricity Market (EMS) and Power Flow (PFS) simulation.
- EMS simulates 3 EU electricity markets and 2 common auction-based mechanisms.
- PFS evaluates an electrical grid power flow with editable grid parameters.
- Both are publicly available for reuse by third-party, avoiding the need to code.
- Results show how they enable realistic simulations of local and wholesale markets.

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