TradeRES
New Markets Design & Models for 100% Renewable Power Systems

TradeRES Research Bulletin

Bidding in Local Electricity Markets Considering Low Voltage Grid Constraints

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Summary

Local electricity markets give end-users the ability to trade electricity at the distribution level. However, distributed energy transactions can threaten the correct operation and stability of the energy grid. This article proposes a local market framework and analyzes the impact that local energy transactions pose on the low voltage grid. A distribution system operator is considered, calculating the power losses and voltage limit violations in the distribution network after the local market is cleared. The proposed framework is validated considering 61 users trading energy in a low voltage grid. Results show an improvement in costs and incomes for market participants and network operation when the local market is considered. Counter intuitively, selecting a plain tariff improves local generation guaranteeing smooth grid operation and energy transactions but affecting consumers' costs. These findings clearly show that more scrutiny of results is needed when several participants with different objectives, including the network operator, are considered in local electricity markets.

Highlights

- A model for optimization of energy bids in local markets including disribution netwkor validation.
- Implementation of a framework and simulation environment including a learning algorithm (the Ant Colony Optimization) for strategic bidding in Local electricity markets.
- Analysis of the impact of local transactions on the distribution network and users' profits considering different grid tariffs.
- Results show that the local market is advantageous for market players and the operation of the distribution network, minimizing losses and voltage limit violations.
- Surprisingly, the grid tariff (upper level for the price that combined heat and power units can offer) limits participation of local producers due to the low cost of imported energy from the grid.
- Further studies are needed in the design and implementation of local markets involving the objectives of a variety of market participants.

Info

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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