Modeling and Optimization for Peer-to-Peer Energy Systems

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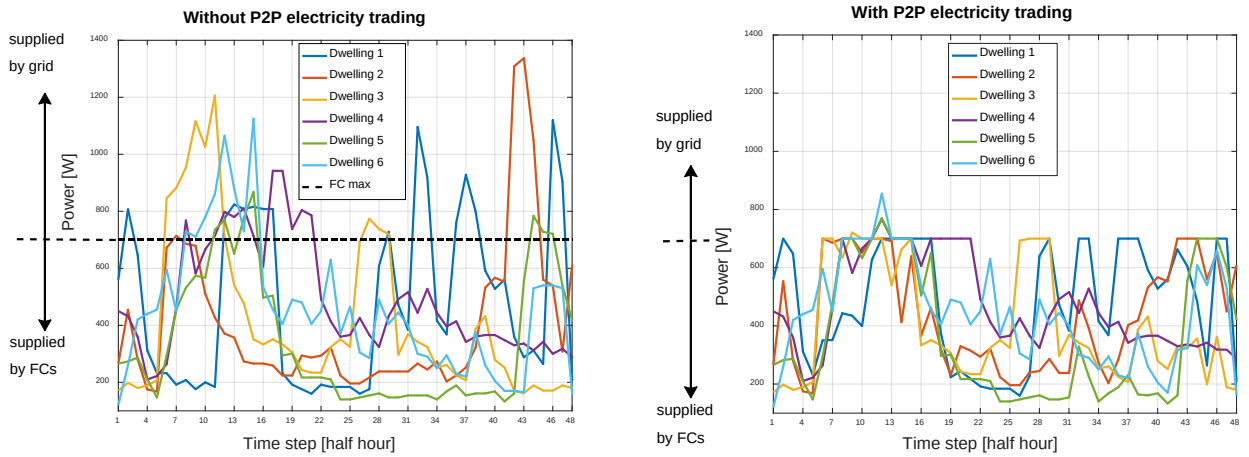
Multiscale Science and Engineering for Energy and the Environment Thrust

The increasing integration of renewable and distributed energy resources into energy grids helps reduce greenhouse gas emissions, but also leads to significant paradigm shifts for both the bulk grid and end-users. Particularly, end-users can switch from passive consumers to proactive prosumers who can both produce and consume energy. As such, prosumers with renewable and distributed energy resources can generate and consume energy locally, instead of exchanging with the bulk grid. To do so, peer-to-peer (P2P) energy systems, a recently emerging approach, is an attractive solution.

In this talk, a recent result based on a *heuristic, interpretable learning* approach to tackle a fundamental, opening problem in P2P energy systems is presented. Then, using it and a novel *linear fitting* method to simplify the operation and management of solid oxide fuel cells (SOFCs), advantages and impacts of a P2P electricity trading system for a local community of residential micro fuel cell combined heat and power (FC-CHP) units are introduced.



※ P2P: peer-to-peer, FC: fuel cell

Fig. 1. Impact of a P2P electricity trading system in a local network of residential micro fuel cell combined heat and power (FC-CHP) units.

References

[1] Dinh Hoa Nguyen, "Optimal Solution Analysis and Decentralized Mechanisms for Peer-to-Peer Energy Markets", IEEE Transactions on Power Systems, Sept. 2020 (Early Access Available). DOI: 10.1109/TPWRS.2020.3021474

[2] Dinh Hoa Nguyen, Tatsumi Ishihara, "Distributed Peer-to-Peer Energy Trading for Residential Fuel Cell Combined Heat and Power Systems", International Journal of Electrical Power and Energy Systems, vol. 125, Feb. 2021 (Early Access Available). DOI: 10.1016/j.ijepes.2020.106533