Organisations

Research Assistant, Department of Electrical Engineering
20/07/2017 → 31/10/2017 Former
egsorin@elektro.dtu.dk
VIP

Center for Electric Power and Energy
22/07/2017 → 31/10/2017 Former
VIP

Energy Analytics and Markets
21/07/2017 → 31/10/2017 Former
VIP

Research outputs:

Peer-to-peer and community-based markets: A comprehensive review
The advent of more proactive consumers, the so-called “prosumers” with production and storage capabilities, is empowering the consumers and bringing new opportunities and challenges to the operation of power systems in a market environment. Recently, a novel proposal for the design and operation of electricity markets has emerged: these so-called peer-to-peer (P2P) electricity markets conceptually allow the prosumers to directly share their electrical energy and investment. Such P2P markets rely on a consumer-centric and bottom-up perspective by giving the opportunity to consumers to freely choose the way they buy their electric energy. A community can also be formed by prosumers who want to collaborate, or in terms of operational energy management. This paper contributes with an overview of these new P2P markets that starts with the motivation, challenges, market designs moving to the potential future developments in this field, providing recommendations while considering a test-case.

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Consensus-based Approach to Peer-to-Peer Electricity Markets with Product Differentiation
With the sustained deployment of distributed generation capacities and the more proactive role of consumers, power systems and their operation are drifting away from a conventional top-down hierarchical structure. Electricity market structures, however, have not yet embraced that evolution. Respecting the high-dimensional, distributed and dynamic nature of modern power systems would translate to designing peer-to-peer markets, or at least to using such a structure in the background for a bottom-up approach to future electricity markets. A peer-to-peer market structure based on a Multi-Bilateral Economic Dispatch (MBED) formulation is introduced, allowing for multi-bilateral trading with product
differentiation, for instance based on consumer preferences. Consequently a Relaxed Consensus+Innovation (RCI) approach is proposed to solve the MBED in fully decentralized manner. A set of realistic case study analyses shows that such peer-to-peer market structures can effectively reduce externalities on power systems with a limited cost increase compared to centralized market approaches. Additionally, the RCI solving approach allows for a fully decentralized market clearing which converges with a negligible optimality gap, with a limited amount of information being shared.

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**Negotiation Algorithms for Peer-to-Peer Electricity Markets: Computational Properties**
Building on the concepts of transactive energy and consumer-centric electricity markets, the interest in community based and peer-to-peer structures to energy transactions and management has substantially increased over the last few years. However, several computational challenges are to be tackled in order for these approaches to be deployed in real-world applications. Our aim here is to identify and analyze these challenges, by comparing distributed community-based market approaches to decentralized and distributed versions of peer to-peer electricity markets. We show convergence trends of the investigated algorithms as well as how they respond to larger number of participants and presence of asynchronicities. Our findings highlight the practical challenges to face with these setups, in particular with peer-to-peer markets, justifying the further proposal of hybrid approaches and of sparsification of negotiation processes.

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以用户为中心的新兴电力市场模式

随着可再生能源在现代能源产业中的占比不断提高，其对现行电力系统和电力市场的运行机制所带来的影响也日趋明显；同时，通过与数字信息产业深度结合，分布式能量管理手段也处于飞速发展阶段。在这二者的驱动下，一种以用户为中心的新兴电力市场模式正以不同的表现形式出现在世界各地。文章以高度概括的方式介绍了这一新兴电力市场模式，浅析了其在不同表现形式下的机理和特征。基于这一新兴电力市场模式在短时期内所取得的发展成就，有理由相信此类新兴电力市场模式将逐步成为未来电力市场中的重要组成部分。