

Pricing and simulating energy transactions in energy communities

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Abstract-

Extensive literature is available for modeling and simulating local electricity markets, often called P2P electricity markets, and for pricing local energy transactions in energy communities. Market models and pricing mechanisms provide simulation tools to better understand how these new markets behave, helping to design their main rules for real applications, and assessing the financial compensations of the internal energy transactions. As such, pricing mechanisms are often needed in energy management systems when centralized management approaches are preferred to market-based ones. First, this paper highlights the links between local electricity markets, pricing mechanisms for local electricity transactions, and other approaches to sharing the collective benefits of participating in transactive energy communities. Then, a standard nomenclature is defined to review some of the main pricing mechanisms for local energy transactions, an innovative pricing mechanism based on the economic principles of a post-delivery pool market is proposed, and other relevant approaches for local electricity market simulation such as Nash equilibrium or agent-based simulation are also revisited. The revision was based on systematic searches in common research databases and on the authors' experience in European and national projects, including local industrial applications for the past five years. A qualitative assessment of the reviewed methods is also provided, and the research challenges are highlighted. This review is intended to serve as a practical guide to pricing mechanisms and market simulation procedures for practical designs of internal financial compensation to share the collective benefits of energy communities.

Index Terms- energy communities; self-consumption; local electricity markets; energy management; transactions pricing; benefits sharing

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