

# Workshop on Energy Flexibility in Smart Buildings and Smart Grids

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Energy Flexibility  
Smart Grid & Buildings

## Coordinating P2P market and distribution grid operation

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**Type of talk:** Invited talk

### **Abstract:**

Increasingly, the empowerment of prosumers through the proliferation of small-scale energy production technologies and flexibility is gaining traction. Such empowerment demands new electricity market designs capable of absorbing prosumers at the energy community's level. Peer-to-peer (P2P) electricity markets fill the gap by allowing peers to exchange power freely and directly with each other, leading to economic advantages while enhancing system-wide efficiency [1]. Nevertheless, the distribution system operator (DSO) must be aware of such energy trades between peers to ensure proper distribution grid operation, thus ensuring that voltage and congestion issues do not take place. In this particular, a thorough coordination between the P2P market and the DSO operation is required [2]-[4]. To assist in this coordination, this presentation shows three mutual-benefit methodologies for coordinating the P2P market and distribution grid operation. The first method entails applying the product differentiation mechanism on an iterative basis to avoid exceeding the technical limits of the lines, which is performed through penalties on power exchanges that may be overloading the grid. After the iterative process concludes, a fully feasible solution for the distribution grid is presented. The second method uses the P2P market with an AC-OPF and ensures network operation with a balancing market via upward and downward regulation. The last one proposes a joint P2P market with an AC-OPF. The methods present reliable results suitable to meet the requirements of market agents, as well as those of the network operator. Fairness in the market is assessed through key performance indicators and the results pinpoint the effectiveness of all methods.

### **Related References:**

- [1] Tiago Sousa, Tiago Soares, Pierre Pinson, Fabio Moret, Thomas Baroche, Etienne Sorin, "Peer-to-peer and community-based markets: A comprehensive review", *Renewable and Sustainable Energy Reviews*, vol. 104, pp. 367-378, 2019.
- [2] Tommaso Orlandini, Tiago Soares, Tiago Sousa, Pierre Pinson, "Coordinating consumer-centric market and grid operation on distribution grid", 16th International Conference on European Energy Market (EEM 2019), Ljubljana, Slovenia, September, 2019.
- [3] Daniel Botelho, Pedro H. P. Barbosa, Leonardo W. de Oliveira, Bruno H. Dias, Tiago Soares, Camile Moraes "Prosumer-centric P2P energy market under network constraints with TDF's penalization" IEEE PowerTech, Madrid, Spain, 28 June – 2 July, 2021.
- [4] Daniel Botelho, Tiago Soares, Pedro H. P. Barbosa, Bruno H. Dias, Leonardo W. de Oliveira, Camile Moraes, "Transações peer-to-peer de energia elétrica considerando as restrições da rede

de eletricidade”, 14th IEEE International Conference on Industry Applications (INDUSCON),  
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