



## Multiagent Simulation of Demand Flexibility Integration in Local Energy Markets

Tiago Pinto <sup>(1)</sup>, Nathalia Boeno <sup>(2)</sup>, Zita Vale <sup>(1)</sup>, Everthon Sica <sup>(2)</sup>

<sup>1</sup> Polytechnic of Porto, Porto, Portugal

<sup>2</sup> Federal Institute of Santa Catarina, Florianopolis, Brazil

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### Summary

Overcoming the issues associated with the variability of renewable generation has become a constant challenge in power and energy systems. The use of load flexibility is one of the most promising ways to face it. Suitable ways to incorporate flexibility in the electricity market, in addition to the already challenging integration of distributed generation primary sources, are therefore crucial. The integration of prosumers and consumers flexibility in the market is, however, not straightforward, as current wholesale and retail market structures are not prepared to deal with the current and future needs of the system. Several models for local energy markets have been studied and experimented; but there it is still not clear what is the most efficient way to integrate the dynamic participation of demand flexibility in this type of local markets. This paper proposes four models of energy transaction in local energy markets considering the integration of consumption flexibility. These models are assessed through the execution of simulations considering the power network of the Portuguese city of Vila Real.

### Highlights

- Four models of energy and flexibility transaction in local energy markets are proposed, based on combinations of asymmetric and symmetric pool models.
- Offers based on bidding curves are considered to incorporate consumers' flexibility
- The power network and real energy resources data from the Portuguese city of Vila Real are used to assess the proposed models through agent-based simulation
- The first important result is that the local market of Vila Real cannot supply its demand only with the generation produced locally, i.e., without application of flexibility or use of the external supplier..
- Results show that having independent market mechanisms for energy and flexibility is more advantageous from the market perspective as it enables achieving lower overall costs
- It is also concluded that the use of bid curves leads to lower flexibility transaction costs



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.



<https://traderes.eu>  
info@TradeRES.eu

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