



The Role of Local Citizen Energy Communities in the Road to Carbon-Neutral Power Systems: Outcomes from a Case Study in Portugal

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Summary

Global warming contributes to the worldwide goal of a sustainable carbon-neutral society. Currently, hydroelectric, wind and solar power plants are the most competitive renewable technologies. They are limited to the primary resource availability, but while hydroelectric power plants (HPPs) can have storage capacity but have several geographical limitations, wind and solar power plants have variable renewable energy (VRE) with stochastic profiles, requiring a substantially higher investment when equipped with battery energy storage systems. One of the most affordable solutions to compensate the stochastic behaviour of VRE is the active participation of consumers with demand response capability. Therefore, the role of citizen energy communities (CECs) can be important towards a carbon-neutral society. This work presents the economic and environmental advantages of CECs, by aggregating consumers, prosumers and VRE at the distribution level, considering microgrid trades, but also establishing bilateral agreements with large-scale VRE and HPPs, and participating in electricity markets. Results from the case-study prove the advantages of CECs and self-consumption. Currently, CECs have potential to be carbon-neutral in relation to electricity consumption and reduce consumers' costs with its variable term until 77%. In the future, electrification may allow CECs to be fully carbon-neutral, if they increase their flexibility portfolio.

Highlights

- Discussions of the required market designs of future electricity markets with near 100% renewable generation;
- Presentation of the current and future key role of CECs towards carbon neutrality;
- Presentation of a case-study that uses real-data to illustrate the current role of CECs, considering self-consumption, microgrid trades and local agreements.



Info

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.



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