

Unintended consequences: The snowball effect of energy communities

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Ibrahim Abada, Andreas Ehrenmann, Xavier Lambin

Abstract Following the development of decentralized generation and smart appliances, energy communities have become a phenomenon of increased interest. While the benefits of such communities have been discussed, there is increasing concern that inadequate grid tariffs may lead to excess adoption of such business models. Furthermore, snowball effects may be observed following the effects these communities have on grid tariffs. We show that restraining the study to a simple cost-benefit analysis is far from satisfactory. Therefore, we use the framework of cooperative game theory to take account of the ability of communities to share gains between members. The interaction between energy communities and the DSO then results in a non-cooperative equilibrium. We provide mathematical formulations and intuitions of such effects, and carry out realistic numerical applications where communities can invest jointly in solar panels and batteries. We show that such a snowball effect may be observed, but its magnitude and its welfare effects will depend on the grid tariff structure that is implemented, leading to possible PV over-investments.

Keywords Energy communities, Cooperative game theory, Non-cooperative game theory, Decentralized power production, Consumer participation, Micro-grids

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Contact
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andreas.ehrenmann@engie.com
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