

On the viability of energy communities

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Abstract Following the development of decentralized production technologies, energy communities have become a topic of increased interest. While the potential benefits have been described, we use the framework of cooperative game theory to test the ability of such communities to adequately share the gains. Indeed, despite the potential value created by such coalitions, there is no guarantee that they will be viable: a subset of participants may find it profitable to exit the community and create another one of their own. We take the case of a neighborhood, having access to a limited resource – e.g. a shared roof or piece of land – which they can exploit if they invest in some renewable production capacity. By joining the community, participants also enjoy aggregation gains in the form of reduced network fees. We find conditions depending on the structure of renewable installation costs, on the magnitude of the aggregation effect and coordination costs and, most importantly, on the chosen sharing rule, under which the whole energy community is stable. Efficiency could require the intervention of a social planner or a change in network tariff structures.

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

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