

Abstract

Local Energy Communities play a pivotal role in the energy transition by fostering local energy generation, particularly with the use of renewable energy resources. These communities offer members with a platform for energy generation, storage and trading possibilities within their locality. To enhance self-consumption incentives and to ensure the viability of Energy Communities, the development of efficient trading and allocation schemes is essential. Recent studies explored various local energy trading methods, resulting in diverse concepts and a lack of a unified framework.

This work investigates the organisation and pricing of energy exchanges within Energy Communities with regard to their economic feasibility. For this purpose, a comprehensive literature review on different trading mechanisms that exist inside Local Energy Markets was performed and presents an economic analysis of related allocations schemes. By examining these concepts, important obstacles and enablers of local energy trading are discussed and linked to the framework of Energy Communities.

Therefore, this work focuses on Peer-to-Peer models and distributed optimisation approaches. Their outcomes and barriers for a successful implementation of Energy Communities are explored in greater detail. To regulate the economic and social relations within the community, fair sharing methods are analysed and frame the allocation of costs and the distribution of benefits among the actors in the network system. The findings of this work provide important insights and identify essential trade-offs regarding the efficiency, fairness, and scalability of these methods. Moreover, significant research gaps are identified and key considerations are proposed to determine the optimal energy trading structure for Energy Communities. Ultimately, this work contributes to the efficient and sustainable development of Energy Communities by examining the design of energy trading systems.