The role of energy communities in accelerating sustainability transitions

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Accelerating sustainable and just transitions is a crucial challenge at the European level, and energy-related practices, activities, organizations, and ecosystems can play a pivotal role in achieving this objective (van der Schoor and Scholtens, 2015; Sovacool et al., 2023). Energy communities, as a means to organize collective energy actions around open, democratic participation and governance, and the provision of benefits for members or the local community (Roberts et al., 2019), emerge as critical instruments in this framework (Lode et al., 2020). They represent a way to develop energy efficiency, finance the transition, increase social acceptance, and stimulate people to adopt virtuous sustainable behaviors (Vernay and Sebi, 2020). In this context, citizens as prosumers, firms, investors, local institutions, and energy-driven policies and incentives have emerged as key actors (Pena-Bello et al., 2022).
Scholarly interest in energy communities has recently surged due to EU-level, national, regional, and local policies aimed at implementing clean energy production, management, and consumption, as well as the current impacts of the Russia-Ukraine war on energy provision and distribution. While various models of energy communities have been proposed, often based on singular case studies (Caramizaru and Uihlein, 2020), the literature remains heterogeneous on the role energy communities play in sustainability transitions and associated changes (Berka and Creamer, 2018; Eitan et al., 2019; Sciullo et al., 2022).

This contribution seeks to address the following research question:
What roles do energy communities play in sustainability transitions?

To answer this question, a systematic literature review informed by a two-step process is conducted. First, a bibliometric analysis is conducted using contributions from the ISI WEB OF SCIENCE and SCOPUS databases, resulting in a collection of 541 papers. Various categories of analysis are implemented to illuminate the evolution of the concept and the current state of the art in the literature, including co-citation analysis, co-authorship network analysis, analysis of the geographical diffusion of contributions, treemaps of involved disciplines, trend topic analysis, thematic maps, factorial analysis, and co-word networks based analysis.
Second, an original content analysis is proposed to examine patterns, themes, and relationships within the existing contributions on the topic.

Preliminary findings suggest that, in addition to energy efficiency, as the less surprising contribution of energy communities to the energy transition, other effects are observed in places where energy communities are located, including:
a) Social change and innovation towards inclusion, socio-economic regeneration and innovation, and improved living conditions for vulnerable and low-income households.
b) Empowerment of citizens and the formation of local social capital, promoting environmentally benign lifestyles.

c) Technological innovation, such as the development of new clean energy technologies and platforms to facilitate operational compatibility and communication across community members, as well as the transition to a decentralized electricity system.
d) Different supporting activities based on renewable energy sources, including new developments in aggregation, mobility, energy sharing, self-consumption, and district heating and cooling.

Our work contributes to the theoretical understanding of the relationship between energy communities and sustainability transitions. Our analysis, in fact, singled out three main components of the intellectual structure of the literature on energy communities and sustainability transitions: energy policies and normativism (mainly at the European level); social aspects of energy communities (such as energy democracy and citizenships); and technical aspects of energy communities' implementations. Moreover, some managerial and policy implications are discussed, shedding light on how energy communities (could) operate in accelerating sustainability transitions, and identifying the main enabling mechanisms at play.

REFERENCES

Berka, A. L., & Creamer, E. (2018). Taking stock of the local impacts of community owned renewable energy: A review and research agenda. *Renewable and Sustainable Energy Reviews*, *82*, 3400-3419.

Caramizaru, A., & Uihlein, A. (2020). *Energy communities: an overview of energy and social innovation* (Vol. 30083). Luxembourg: Publications Office of the European Union.

Eitan, A., Herman, L., Fischhendler, I., & Rosen, G. (2019). Community–private sector partnerships in renewable energy. *Renewable and Sustainable Energy Reviews*, *105*, 95-104.

Sciullo, A., Gilcrease, G. W., Perugini, M., Padovan, D., Curli, B., Gregg, J. S., ... & Muiste, M. (2022). Exploring Institutional and Socio-Economic Settings for the Development of Energy Communities in Europe. *Energies*, *15*(4), 1597.

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers* (Vol. 1). John Wiley & Sons.

Pena-Bello, A., Parra, D., Herberz, M., Tiefenbeck, V., Patel, M. K., & Hahnel, U. J. (2022). Integration of prosumer peer-to-peer trading decisions into energy community modelling. *Nature Energy*, *7*(1), 74-82.

Roberts, J., Frieden, D., & d'Herbemont, S. (2019). *Energy community definitions*. Compile project: Integrating community power in energy islands. May, 2019.

Lode, M. L., Te Boveldt, G., Coosemans, T., & Camargo, L. R. (2022). A transition perspective on Energy Communities: A systematic literature review and research agenda. *Renewable and Sustainable Energy Reviews*, *163*, 112479.

Sovacool, B. K., Brugger, H., Brunzema, I., Dańkowska, A., Wemyss, D., Vernay, A. L., ... & Rogge, K. S. (2023). Social innovation supports inclusive and accelerated energy transitions with appropriate governance. *Communications Earth & Environment*, *4*(1), 289.

van der Schoor, T., & Scholtens, B. (2015). Power to the people: Local community initiatives and the transition to sustainable energy. *Renewable and sustainable energy reviews*, *43*, 666-675.

Vernay, A. L., & Sebi, C. (2020). Energy communities and their ecosystems: A comparison of France and the Netherlands. *Technological Forecasting and Social Change*, *158*, 120123.