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## 5. Energy communities as accelerators of energy transition in cities

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*"The European Green Deal states that greenhouse gas (GHG) emissions should be reduced by at least 50% by 2030, and that there should be no net GHG emissions by 2050. The energy sector is a key in this transformation, and energy communities can act as accelerators of transitions."*

**Keywords:** energy communities, decentralised energy systems, energy democracy, energy justice, energy citizens, urban transition

### Key findings:

- Future scenarios outline a decentralized energy system in which smaller generation units have become more economically viable and turned economies 'upside down'.
- This will be an energy system with increased penetration of information technologies, allowing for more flexible and less hierarchical management of infrastructure.
- This future system will also entail, for example, the increased electrification of transportation infrastructure and the increased use of heat pumps in energy-efficient buildings.

## 5.1 Introduction

The European Union's (EU's) Green Deal states that greenhouse gas (GHG) emissions should be reduced by at least 50% by 2030, and that there should be no net GHG emissions by 2050 (European Commission, 2019b). The energy sector is a key sector in this transformation, which will include increased electricity generation from renewables, improved energy efficiency, and replacement of combustion technology (Commission, 2016). Future scenarios outline a decentralized energy system in which smaller generation units have become more economically viable and turned economies 'upside down' (Kojonsaari and Palm, 2021). This will be an energy system with increased penetration of information technologies, allowing for more flexible and less hierarchical management of infrastructure. This future system will also entail, for example, the increased electrification of transportation infrastructure and the increased use of heat pumps in energy-efficient buildings (Lunde et al., 2016; Maya-Drysdale et al., 2020; Siemens et al., 2019).

Cities are important experimentation spaces supporting and accelerating this transition (Palm and Bocken, 2021; Voytenko et al., 2016), not alone, but together with many other actors, especially neighbourhoods and citizens. Decentralized energy systems can empower and engage local communities by increasing citizen control over energy resources. At the same time, local communities can also drive and lead the energy transition. Such a development is outlined in the EU's 'Clean Energy for all Europeans' package (CEP), and a key actor identified in the CEP is the energy community (EC) (European Commission, 2019a). An EC is defined as formed by the collaboration of local stakeholders who produce, consume, and manage their own energy for the primary purpose of creating economic, environmental, and social benefits for the community (Walker and Devine-Wright, 2008). Participation in ECs can take different forms, for example, through energy cooperatives owning wind power plants, market aggregators, and communities jointly owning battery storage (Ines et al., 2020). ECs can also have different organizational and decision-making structures (Hicks and Ison, 2018).

The CEP is or will be translated into national regulations, leading to an increase in ECs throughout Europe. Many European countries have also implemented policies to make it easier for citizens to develop ECs (Ines et al., 2020; Palm, 2021b). According to REScoop.eu, there are 1900 energy cooperatives within the EU as of 2021, and the number is growing. This EC trend is still in an early phase, however, and many questions remain as to what role ECs will play in the future and how central they will be to the energy transition (Blasch et al., 2021). In this chapter, the development of ECs is discussed in relation to the hopes and challenges connected to their emergence. The chapter ends with a discussion of how cities can support the creation of decentralized, participative, and renewable ECs.

Energy communities: the hopes

The energy sector plays a prominent role in the European and global economies. Even though the energy intensity of the European economy decreased by over 30% between 1995 and 2016, energy costs have remained high in Europe, usually explained by rising fossil fuel prices (De Pascali and Bagaini, 2019). This, together with the energy sector's contribution to GHG emissions, makes transition to an energy system based on renewables a priority. Most

countries in the world have also ratified targets to increase the amount of renewable energy (REN21, 2017).

Increased use of renewables entails a shift to a more decentralized energy system with distributed supply and storage. Distributed demand is often more flexible, which is beneficial for system optimization (Blasch et al., 2021). Electrical energy produced by a decentralized system has the advantage of reduced transmission distance: it can feed into community distribution systems, relieving the transmission grid of congestion, which is increasingly important for many grids (Brown and Lund, 2013; Palm, 2021a). If a decentralized energy system is designed inclusively, ECs will have many opportunities to flourish and contribute to the engagement and empowerment of local communities (Blasch et al., 2021). With appropriate support, ECs have the potential to shift the energy system from a top-down to a bottom-up dynamic, involving a shift of responsibilities from centralized to decentralized actors (Ghiani et al., 2019; Kojonsaari and Palm, 2021). Such decentralization would encourage the increased interaction of all users with the technology.

EC development is still in an early phase and is still considered a niche phenomenon (Blasch et al., 2021). Early-emerging ECs are seen to have multiple benefits and are often discussed in the context of both energy democracy and citizen empowerment (Wuebben et al., 2020). ECs have the potential to contribute to increased energy literacy among citizens, helping individuals learn about the interrelationships between energy and sustainability (Wahlund and Palm, under revision). Wuebben et al. (2020) illustrated how ECs empower people to demand both cleaner energy and the renewal of energy policies. People organized in ECs can change the regulatory framework and enhance organizational participation (Vihalemm and Keller, 2016).

The importance of ECs for local communities and economies has been stressed in earlier research (Busch et al., 2019; Gui et al., 2017; Hoppe et al., 2015; McKenna, 2018; Walker and Devine-Wright, 2008). There is some evidence that medium- and small-scale wind and hydro projects have positive local economic effects. However, much of the relevant research is based on anecdotal evidence emerging from one-time interviews with project participants and residents, and there is a notable lack of systematic analyses of ECs' long-term effects on local economies (Berka and Creamer, 2018).

Earlier studies have emphasized the many benefits that accrue to individual EC members (Bomberg and McEwen, 2012; Koirala et al., 2016). Individual citizens can face less risk when joining an EC than when investing in an individual energy solution such as a rooftop photovoltaic (PV) installation (Koirala et al., 2016). Others have found that social motivations such as actively participating in the energy transition are as important as or even more important than financial motivations (Hanke and Lowitzsch, 2020; Tricarico, 2021). There are also indications that customers are prepared to pay more for locally generated power and that the local nature of this power builds trust in the energy system (Koch and Christ, 2018). Other potential benefits are that ECs can increase the welfare of low-income households and contribute to the collective distribution of benefits (Koirala et al., 2016). Coy et al. (2021) showed that ECs can foster engagement in the energy system and make passive consumers into active ones. When people feel empowered they also engage more and feel responsible for their consumption (Dóci, 2021).

The facilitation of ECs is central to the future thriving of ECs, and the role of the cities in this facilitation is discussed below. First, however, some of the challenges of decentralized systems and emerging ECs will be discussed.

## **5.2 The challenges facing energy communities**

Energy communities are not a new phenomenon. Many countries have had wind or solar cooperatives in place for ages. In theory, these have an open set-up in which all citizens can be included, but this has not been the case in practice. For example, in Germany more than 70% of energy cooperative members have been male, with relatively higher education and income. People with lower income have been especially underrepresented, due to the need to access financing to take part (Hanke and Lowitzsch, 2020). In Germany, a member usually needs to buy shares, and the average individual contribution to a cooperative amounts to EUR 3899 with an average required minimum contribution of EUR 511 (Hanke and Lowitzsch, 2020). Many households do not have enough savings to prioritize spending such a large amount upfront on EC membership. Financial resources are often cited as a main barrier to participation in an EC (Bomberg and McEwen, 2012; Koch and Christ, 2018; Koirala et al., 2018; Rahmani et al., 2020).

Another cited challenge has been that ECs contribute to energy injustice, since the EC has historically not been an organizational form suited to people living in apartments or renting their homes. Earlier studies have treated ECs as a niche activity for an exclusive set of actors. Inês et al. (2020) saw a continuous risk of the exclusion of more vulnerable communities and lower-income families given the costs as well as the organizational and knowledge needs of groups of citizens intending to set up ECs. Van Veelen (2018), on the other hand, showed that even if inclusivity is prioritized, the ideals of inclusive decision making and robust accountability procedures could be at odds with the practicalities of implementing these measures. The inclusion of previously underrepresented groups in decision making does not automatically guarantee the transfer of power, as internal forms of exclusion may remain. There might, for example, be unwillingness to speak in meetings due to perceived power imbalances or out of fear that the opinions expressed will be ignored. ECs have also experienced a kind of gender bias in relation to both membership and leadership (Allen et al., 2019).

Other challenges to EC flourishing are the reliance on volunteers and the risk of free-riding when members join without contributing to EC activities (Dóci, 2021). The reliance on lay volunteers is an increasing problem, due to a predictable increase in the complexity of running and managing energy systems. System complexity is increasing due to the interconnectedness with other systems, devices, and services. The electricity system, ICT, and the transportation sector are becoming more and more integrated and interdependent. The electricity system is also increasingly incorporating demand response features, which call for knowledge of how to control and optimize electricity generation, distribution, consumption, and storage. Future ECs are likely to be increasingly dependent on partnerships with commercial actors. This is already being seen today when ECs typically rely on the Distribution System Operators (DSO) that operates the local distribution network (Blasch et al., 2021; Nolden et al., 2020).

Many EU countries need grid investments due to aging electricity infrastructure and increased use of intermittent power generation sources (IEA, 2019; Mateo et al., 2017), which will likely entail increased grid costs for all customers. Microgrids can be an alternative to grid up-grades, and can both enhance the reliability of the grid and lower associated grid costs (Kojonsaari and Palm, 2021). The establishment of microgrids for peer-to-peer markets is beneficial for ECs (Bukovszki et al., 2020). Other customers, not part of an EC and unable to invest in a microgrid, could face higher costs because they must carry a bigger share of the cost of the existing grid as microgrid owners drop out of this common utility. Customers left in the traditional main grid are often the vulnerable consumers. They cannot afford to join and benefit from emerging energy grid communities and will face the increased burden of rising grid tariffs, levies, and energy costs (Hanke and Lowitzsch, 2020). Cities can assume several roles in supporting ECs and removing or at least reducing barriers. The roles of the city will be discussed next.

### **5.3 The city as an enabler of energy community flourishing**

The city can play an important role in institutionalizing more participatory forms of energy provision and governance by supporting the establishment of ECs. Earlier research identified major barriers to bottom-up initiatives such as ECs, namely, the centralized design of the existing system and regulations benefitting traditional regime actors (Brummer, 2018; Koirala et al., 2018; Kooij et al., 2018; Warbroek et al., 2018). Brummer (2018) found, for example, the existence of a regime in the United Kingdom discriminating against small community-driven initiatives and benefitting big energy companies. Within the energy democracy research community, civic ownership of power generation and transmission infrastructure has been emphasized as important for more participatory forms of energy provision and governance (Becker and Naumann, 2017). Most countries possess centralized systems, so there is a need for cities to find ways to support ECs. This support needs to be simultaneously localized and adapted to national and local contexts.

EC research has traditionally applied a bottom-up perspective in which it has been emphasized or expected that the citizens are the ones initiating EC establishment. This perspective is problematic and is now increasingly questioned in both policy and research. The CEP emphasizes, for example, the important role of local governments in relation to ECs. Historically, municipalities and other state actors have contributed to the formation of ECs (Blasch et al., 2021). In some countries, such as Sweden, cities have long occupied a strong position in the energy system. Many cities own energy companies and cities are often in the forefront of the energy transition (Palm, 2004). Cities have also played an important role in the emergence of ECs. Some city-owned energy companies have adopted business models similar to those of ECs. Some wind cooperatives, as well as some solar PV cooperatives, have been started by these companies. These actors have motives similar to those underlying ECs, i.e., to increase renewable energy production. Municipally owned energy companies have also played an important role as consultants to ECs as well as by providing economic support, as in the famous Swedish case of Sala-Heby Energi AB. Many ECs would not have been successful without support from the municipally owned energy company (Magnusson and Palm, 2019). This has been especially true for PV cooperatives, as those receiving city support have survived while others have disappeared. In many Swedish cases, it has been the cities and local energy companies that have engaged and enrolled citizens, and the

initiatives have not been citizen led to start with (Magnusson and Palm, 2019). This is one important role cities have played and can continue to play in the future in supporting ECs.

Other ways cities could support ECs are by providing debt guarantees or subsidies targeting low-income groups (Hall et al., 2019; Hanke and Lowitzsch, 2020). Earlier research has highlighted the importance of public funding, subsidy mechanisms, and dedicated support programmes for the development of ECs (Creamer et al., 2018; Gancheva et al., 2018; Hall et al., 2018; Ines et al., 2020; Walker, 2008). One good example of how cities and regions can do this is the Community Renewables Initiative (CRI) put forward by the Countryside Agency in the UK (Walker et al., 2010). It seems particularly difficult to secure funding in the early stage of EC formation when plans are to be implemented, and cities could take a supportive role in this.

The lack of tailored policies for ECs is one often-cited barrier (Gancheva et al., 2018; Ines et al., 2020). Earlier research has often emphasized that cities should adopt policies and outcomes promoting ECs (Gancheva et al., 2018; Ines et al., 2020; Kooij et al., 2018). It has been noted that lack of political support and lack of access to politicians and policymakers are barriers to EC development (Brummer, 2018). Kooij et al. (2018) discussed how political discourse can enable ECs. Their study found that Denmark had a beneficial discourse emphasizing renewable energy, while the lack of such a discourse on cooperatives and ECs in Sweden constituted a barrier. If cities have alternative visions of the energy system that can guide and inspire actors to initiate ECs, this would spur the emergence of ECs (Palm, 2021b; Ruggiero et al., 2018). Historically, EC actors have found that cities are reluctant to work with them, making them unsure of what to expect from cities (Wagemans et al., 2019). Clear city policies and elaborated visions could both enhance and strengthen the collaboration.

#### **5.4 Concluding remarks on ECs and the role of cities**

ECs have the potential to contribute to the energy transition by both increasing the amount of renewable energy in the system and fostering citizen participation. There is some evidence that ECs create value for both their members and society. ECs also face many challenges in moving from being niche players to established actors attracting majority participation from citizens. Some identified barriers concern difficulties raising the upfront investment needed to start an EC and setting membership fees that do not exclude low-income households.

Cities can play a significant role in helping ECs emerge and thrive. The role of cities, however, is under-researched in relation to ECs, possibly because ECs have tended to be a rural rather than urban phenomenon (Busch et al., 2019). ECs in urban areas will require different energy technology from that used by rural ECs. Rural areas have more space and can combine, for example, wind and solar power, whereas denser urban areas will need to rely more on district energy and PV power generation. Many issues will also be the same, such as the role of ECs in the energy transition and the need to secure funding early in the establishment process to cover investment costs.

Cities can play an important facilitating role for these urban ECs. They can build institutions that address the need to cover upfront costs early on and that can support low-income

households in becoming members. The traditional bottom–up perspective emphasized in the EC literature in which citizens are supposed to take the lead is problematic, however, and should be reconsidered so as not to become a barrier to the future development of ECs in cities. ECs cannot develop independently of socio–historical factors, so ECs need to adapt to national and local institutional settings. In some countries, as was the case in Sweden, cities might need to take a major role in initiating ECs, giving increased responsibility to citizens only at a later stage. In other countries, such as Germany and Denmark (Lauber, 2004), traditional initiatives such as farmers’ cooperatives have formed around citizens as well as public and private companies. One important role for cities in Denmark and Germany could be to create meeting arenas or to facilitate collaboration between different actor constellations. These are just some of the many ways citizens can become engaged and some of the many roles cities can play.

Cities can benefit from ECs as well. Research on ECs shows that when local citizens come together and collaborate on energy projects, this often builds trust in the community. EC members increase their energy literacy and build confidence to act as energy citizens, becoming actively involved in the energy transition. With the right preconditions, ECs can also contribute to a more just energy system in cities, involving diverse households. To achieve this, cities need to engage ECs and help them emerge in a way that encompasses diverse interest and values. How cities can enact their role in this development and how cities can benefit from the potential of ECs clearly merit further research.

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