

Energy prosumers and cities



In an increasingly urbanised world, cities and municipalities play a key role in the energy transition and the decarbonisation of society. Prosumers (producer-consumers) of renewable energy can help to accelerate this transition in cities. This briefing builds on recent EEA work on prosumption by focusing on the challenges and opportunities that urban areas present, and on how local authorities can promote prosumption in their cities.

Key messages

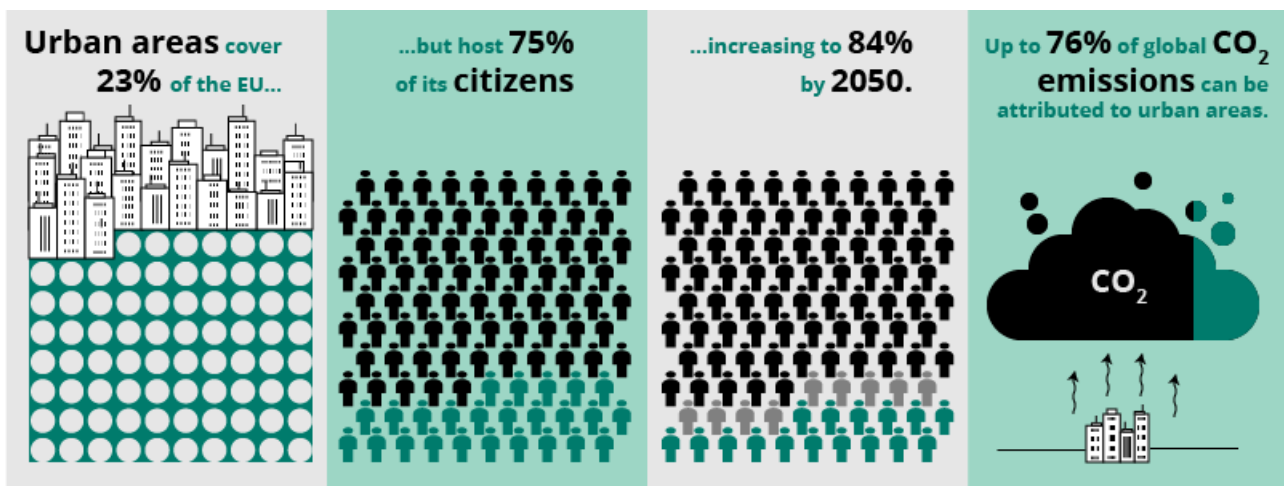
- ➔ Establishing prosumption in cities is more challenging than in rural areas because of the limited space available for energy generation and the more complex arrangements for the ownership of surfaces (e.g. rooftops in apartment blocks).
- ➔ However, shorter travelling distances and the possibility of establishing integrated energy districts provide opportunities for sector coupling (e.g. among the electricity, heating, cooling and mobility sectors).
- ➔ Generating electricity outside the city (offsite generation) opens up possibilities for prosumers to overcome the lack of space.
- ➔ Municipalities can support prosumption by providing surfaces that can be used for citizen-led energy generation, such as the rooftops of public buildings or unused municipal land. They can also offer targeted financial support schemes to prosumers and set requirements for companies to promote citizen participation.
- ➔ Municipalities can encourage the involvement of citizens in energy planning. They can also act as information hubs and centres of expertise, and contribute to building the right skill pool in their cities.

Urbanisation and prosumption

The world is becoming increasingly urban. The share of the urban population is rising and, despite covering relatively small surfaces, urban areas are estimated to be responsible for up to 76% of global energy-related carbon emissions. Europe is no exception. Around three quarters of the EU's total population lives in cities and suburban areas, and this proportion is projected to increase over the coming decades (see Figure 1). At the same time, the dynamism and density of cities mean that they have great potential to become models for low-carbon lifestyles (Agora Energiewende, 2019; EEA, 2021).

Figure 1. Key facts on cities and climate change

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Sources: UNFCCC (2017); UN (2018); EEA (2022a).

Prosumers of renewable energy can make a critical contribution to decarbonising their communities. Prosumers are defined as entities — individuals, households, small or medium-sized enterprises (SMEs), or institutions — that actively participate in the energy system. Active participation can be through self-generating renewable heat or power, and also through providing energy system services such as demand flexibility and energy storage services, enabling larger amounts of intermittent wind and solar energy to be integrated into the system. Prosumers can act as individuals (e.g. a single household) or as part of a collective (e.g. a block of apartments or an energy community). A comprehensive overview of prosumers and the different models of prosumption is available in the recent EEA report *Energy prosumers in Europe: citizen participation in the energy transition* (EEA, 2022b).

Each city is unique, with its own characteristics and solutions. However, cities have some common attributes that establish a setting for prosumption that is distinct from the setting in more rural areas. For example:

- Cities are more **densely populated** than rural areas, making rooftop solar technology the renewable technology of choice rather than technologies that require open space, such as wind turbines. The higher population density of cities also makes heat grids more profitable than in rural areas, thus offering potential to develop prosumer initiatives related to heat grids in cities.
- More people live in **apartment blocks** in cities. This makes it harder to coordinate investment, since it requires agreement among several people with different interests and financial capabilities.
- **Short travel distances** make cities ideal for using electric vehicles, both private and public. Urban prosumer concepts are thus more likely to involve coupling between the energy and mobility sectors, for example in the form of onsite renewable energy plants delivering power for charging electric vehicles.

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- Cities can offer opportunities for developing **integrated energy districts**, for example when areas within a city are redeveloped or new areas are added. Integrated energy districts often use a variety of energy technologies and are used by a variety of interconnected sectors.

Some prosumption models are especially relevant to cities

Electricity generation on apartment block rooftops

Apartment blocks have a smaller rooftop area per inhabitant than houses. Depending on the architecture and height of the buildings, shadowing effects from neighbouring buildings may also limit the area of a rooftop that is suitable for solar photovoltaic (PV) energy generation. At the same time, a high population density will mean a high energy demand close to the point of energy generation, minimising transmission losses. This combination of relatively low generation potential and high energy demand highlights the importance of maximising the use of suitable rooftops for energy generation in cities.

However, organising investment for a joint PV plant or implementing collective self-consumption in an apartment block is significantly more complicated than doing so in a single-family home. Different ownership structures and country-specific regulations mean that problems and challenges vary. In all cases, however, the relevant parties must discuss and agree on a specific approach to organising investment in and the operation of the rooftop system. The collaborative nature of this model can have positive effects on the community, although it can also pose a barrier to prosumer projects if agreements cannot be reached. An alternative to collaborative investment is to lease the rooftop to a third-party operator and for apartment block owners to receive some of the energy generated in lieu of lease payments.

Outside the scope of municipalities, national housing policies have an important impact on the deployment of rooftop PV energy systems in apartment blocks. Decision-making and access to finance may be easier when the building is owned by a single entity rather than multiple private owners. Therefore, countries with high shares of social housing, housing associations or large landlords might make more progress in this regard than countries with lower shares.

Offsite electricity prosumption

The possibility of generating electricity in one location and consuming it elsewhere, known as offsite generation, enables many citizens to become prosumers irrespective of the space they have available. Virtual net metering is one option used in offsite prosumption models. With virtual net

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metering, prosumers can generate electricity outside the city (e.g. at a second home or as part of an energy community) and inject this electricity into the grid. The prosumers then get a discount in their household energy bills based on the energy generated (Box 1). National regulation should support offsite prosumption concepts. However, as offsite prosumption requires the use of the national electricity grid, grid fees and other related costs must be taken into account and covered by the offsite generation project.

Box 1: Virtual net metering for members of Athens' first energy community, Hyperion

Athens' first energy community, 'Hyperion', will enable community members in the city of Athens to consume electricity from collectively owned ground-mounted photovoltaic (PV) plants outside the city by using virtual net metering. This is enabled by national legislation. Each member owns a share of the electricity generated equivalent to their share of the equity. That share of the electricity generated will then be accounted for on the member's energy bill. Members of the community benefit from economies of scale because they share the fixed costs of setting up the remote renewable plants (Association of Photovoltaic Companies, 2020). Since electricity is not generated close to the consumption sites, the widespread adoption of this support scheme might require the modernisation of Greece's electricity grid.

Prosumers in integrated energy districts

In an integrated energy district (often a newly built or converted area), inhabitants can actively participate in a local energy system that integrates electricity, heating and mobility. As a simplified example, an integrated energy district can generate its own renewable energy, providing electricity to the community, for instance by providing charging points for a local electric car-sharing scheme. At the same time, it can power a small district heating network supplemented with heat pumps. This integration between different sectors is sometimes referred to as 'sector coupling'.

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The concrete implementation and ownership arrangements necessarily differ between districts, depending on local conditions and the participants involved^[1]. For example, an energy cooperative could invest in and operate the energy system. Alternatively, a commercial entity could manage the energy aspect of the district and offer inhabitants the option to get involved when they move into the area.

In integrated energy districts, citizens can participate as advisers, idea providers and discussion partners during the development process if the community's planning and development approach allows this. Furthermore, citizens can act as investors, contributing their own money, time, labour, skills and expertise. This could happen in different 'legal' or regulatory settings such as working groups, initiatives and associations, or cooperatives, or as part of private non-profit or for-profit organisations.

Cities can promote prosumption

Cities can play a very important role in enabling prosumption, even if the main relevant laws and regulatory frameworks are set at a national level.

Providing space for prosumption

Cities often own public buildings (e.g. schools, sports facilities, administrative buildings) and dominate shares of public companies (e.g. housing associations or local utility providers), as well as owning land areas within the city. Thus, municipalities can use their own buildings for prosumption or allocate unused land, such as brownfield land or railway margins, to local energy communities for energy generation. They can encourage publicly owned companies to initiate and invest in collective prosumer models (Becker et al., 2017). In the case of private companies, municipal governments can use their convening power to bring key local stakeholders together and — possibly — initiate memoranda of understanding with the same aim.

Setting up support schemes and requirements

Municipal authorities can set up their own support schemes when such approaches are deemed desirable and compatible with national law. This could be in the form of direct financial support for projects or indirect support through tax relief. They could also procure locally produced electricity and increase the visibility of citizen-led projects and initiatives (Haf and Robison, 2020).

In addition, municipalities can set requirements or terms and conditions for awarding energy infrastructure concessions to companies or initiatives that enable citizens to participate in decision-

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making processes.

Involving citizens in energy planning and local governance

Municipalities are usually responsible for many energy-related decisions. Integrated energy planning and management are often central tasks of municipalities, in collaboration with regional and national authorities. Through the development of dedicated masterplans and strategies, municipalities can lay down their ambitions for the energy transformation, make it clear who is accountable for progress and clarify what the role of citizens should be in the decarbonisation process. Critically, the development of these local masterplans should involve citizens, in a participatory process, so that inhabitants, as important stakeholders, are consulted and can express their opinions (Judson et al., 2020).

For citizens to take an active role in local planning, municipal authorities need to be approachable, with an open-door policy, and adopt participative governance strategies (Haf and Robison, 2020). In addition, a framework for cooperation among local stakeholders, such as municipalities, energy communities, energy utility providers and citizens, should be put in place.

Providing information and attracting skills

Developing and implementing prosumer concepts often requires high levels of expertise and specialist knowledge in many different areas. Information is usually dispersed across several stakeholders. Actor constellations and interactions are often unique, which might lead to considerable transaction costs for aspiring prosumers. This is particularly true in cities, where becoming a prosumer tends to be more complicated than in rural areas.

As highlighted in the REPowerEU plan and its EU solar strategy, a key action for incentivising prosumption is to set up one-stop shops that give citizens impartial advice and practical help on roof renovations, solar generation and energy storage in an integrated manner, covering everything from the technical requirements to the administrative steps and financial support available. Local and regional authorities, and their implementing institutions, such as energy or business support agencies, are well suited to this task, functioning as aggregators of information and facilitators and helping to bring stakeholders together (Bale et al., 2012).

Finally, cities can contribute to addressing the skills shortage, which is becoming an increasingly important barrier to the deployment of prosumer and energy efficiency projects. Adapting vocational training to current needs usually depends on the actions of national or regional authorities, and is constrained by educational regulatory frameworks. Nevertheless, cities can help to ensure that existing skills are put to good use by providing incentives for suitably qualified people to set up businesses. Incentives could include subsidising workshop space and providing local tax breaks. Municipal authorities can also join the Pact for Skills large-scale skills partnership, as encouraged by

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the REPowerEU plan.

Notes

[1] Design elements include the sector (power, heat, mobility), technologies, activities (generation, storage/flexibility, network, use concept, operation), legal structure (rights, liability, ownership), type of participant (citizen, community, private firm) and type of involvement (member, investor, operator, owner, user).

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