

PED

Knowledge Hub

Position paper
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This position paper is an output from the DUT Knowledge Hub where authors argue for the need of demonstrating a clear financial advantage of Positive Energy Districts (PEDs) over other energy services to make the PED pathway scalable. Experts and representatives from DUT projects contributed and reviewed the output. The recommendations and statements are directed to municipalities.

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RESILIENT, INCLUSIVE, AND COMPETITIVE? Decoding Economic Viability for PEDs

KEY MESSAGES

- Authors argue that Positive Energy Districts (PEDs) can already be economically superior mainly through offering reduced energy costs for consumers, yet at present rely on highly motivated volunteers which is unsustainable and unscalable.
- Cities can more effectively support PEDs by advocating for, and assisting, widespread access to energy sharing through regulation.
- In addition, when communicating with citizens, cities should highlight how PED initiatives reduce monthly costs, increase local energy self-reliance, and protect residents from future market volatility, connecting with the primary concerns of most mass market energy consumers.

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INTRODUCTION

PEDS IN 2026: EVOLVING TOWARDS SOCIETAL READINESS

To deliver on DUT's mission of climate neutral and smart cities for Europe requires proof not only that the PED pathway is technically feasible, but also that PEDs can be a real mass-market alternative to grid energy, supported by compelling economic evidence.

To cross the "innovation valley of death" from subsidised demonstration projects towards large-scale societal and market readiness of PED solutions, competitive economic and societal innovations are needed alongside the technical innovations, such as digital energy monitoring and long-term seasonal storage.

ENERGY AFFORDABILITY – BRIDGING CITY AND CITIZEN PRIORITIES

WHAT DO CITIZENS AND CITIES CARE ABOUT?

Many early-stage PED and energy community projects have until now focused on collaborative and participant-driven governance as their primary engagement approach. Driven by a valid concern to "leave no one behind" in Europe's clean energy transition, both cities and communities have shared a vision of a citizen-driven design process of local energy systems, such as installing solar PV arrays and storage across a neighbourhood to reduce bills and raise extra income.

However, there is now increasing evidence – anecdotally and scientific – that this vision has some important limitations. **The participatory model relies heavily on a narrow consumer segment of time-rich and highly motivated volunteers**. It is also administratively burdensome, so offering limited potential for both replication (i.e. repetition in another context) and scaling (i.e. growing in size). Further, there is growing concern that participatory co-design can in fact exclude the most vulnerable segments of the population, unable to participate in community meetings due to competing work, family, or economic demands. **Unfortunately, Europe's inclusive urban energy approaches may often unintentionally exclude**. New perspectives for balancing an inclusive and also rapidly scalable energy transition are therefore urgently needed.

In parallel, research across both academia and industry has helped reveal the most pressing priorities of typical mass-market urban energy consumers: the vast majority of consumers care first and foremost about the price and stability of their energy supply (see Table 1).

"Citizens do not engage with PEDs as a technical concept – they engage when the conversation is about lower energy bills and more stable energy costs."

Daniele Vettorato,
EURAC, 4A4PEDs project

To truly scale as a competitive concept, PEDs cannot rely on voluntary civic duty alone, but must offer a clear financial advantage to grid energy supply. PEDs must deliver a value proposition that the grid on not only cost, but also on simplicity, low administration, and management.

Priorities in 2026	Citizens	Cities	Europe
	Arrows indicate change in priority since 2020		
1	Affordability ↑	Environment ↓	Affordability ↑
2	Green ↔	Investment Cost ↔	Source ↑
3	Source ↔	Community ↓	Green ↓
4	Community ↓	Affordability ↑	Community ↓

Table 1: The changing priorities of the energy transition are reflected in updated policy documents of the European Commission, such as the Green Deal in 2020 to the more recently in Draghi's report on competitiveness in 2025.

ENERGY AFFORDABILITY TAKES CENTRE STAGE IN EUROPE

Major geopolitical events (such as Ukraine's invasion in 2022 and the strait of Hormuz crisis in 2026) have brought renewed attention to the importance of energy affordability and regional energy security - and the costs of ignoring them. Cities typically view the energy transition as an expense - "the cost to become climate neutral". Indeed, a typical city of 100,000 households spends <€500m per year on energy (Figure 1). This figure is currently treated as an inevitable and rising overhead cost, similar to staff salaries and software subscriptions.

Europe's energy bill has increased by almost €50bn since the Hormuz crisis.

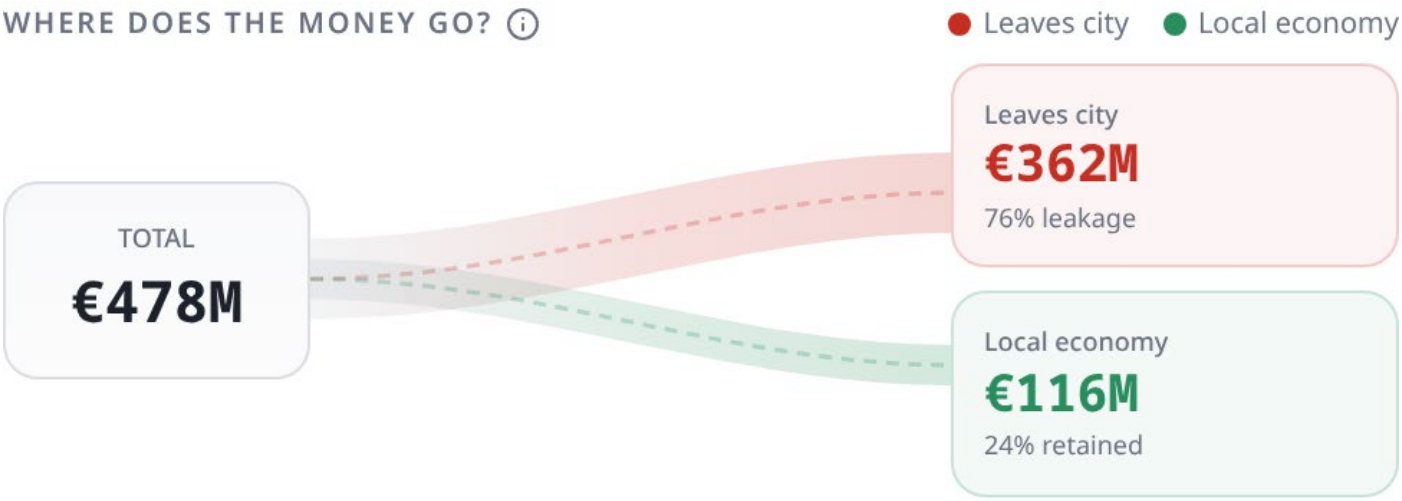


Figure 1: Cities respond more actively when their energy is reframed as a city-wide bill rather than a purely technical challenge (Bax city energy bill analysis for Dordrecht, the Netherlands).

Instead, however, city energy costs can be reframed as **money leaking out of the local economy** every month. This "city energy bill" concept can help reframe the energy transition challenge not as inevitable cost but as an investment opportunity to retain local value, and to steer strategic solutions more likely to achieve buy-in from citizens.

"For cities, resilience and the cost of inaction are more persuasive than technical discussions about energy systems. When presenting to the City of Vienna, they paid attention only after seeing the simulated costs of not investing in local renewables"

Jan-Phillip Richtmann, TU Wien, Pol4PEDs project



Indeed, as the cost of local renewable generation continues to drop, investment in local energy represents an increasingly smart investment in new local wealth creation and resilience, with a clear triple win for communities:

1. **Reduced net costs**: Locally generated energy delivers an immediate, direct saving on the energy bill for citizens.

2. **Local wealth development**: The remaining portion of the bill can be reinvested into community energy assets themselves through a revolving fund, keeping capital within the local economy and boosting demand for local jobs, business models, and services.

3. **System robustness**: It builds regional infrastructure resilience, shielding the community from external macro-shocks.

PEDs are, therefore, where cities and citizen priorities intersect: they support the climate goals of municipal governments whilst meeting the priorities of energy affordability and reliability for homes and businesses (Figure 2).

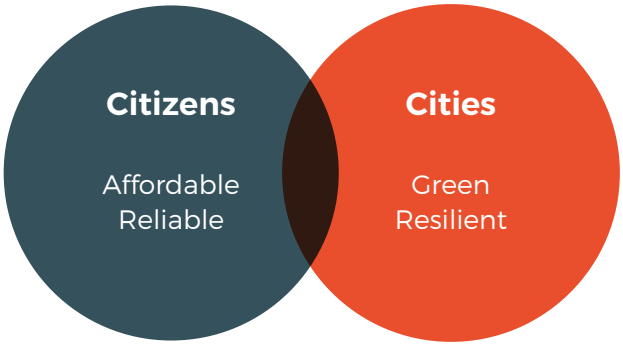


Figure 2: PEDs align city and citizen priorities.

THE CONSUMER ENERGY PRICE WEDGE

Energy prices vary significantly between countries, ranging from €0,10/kWh in coal-based south-eastern Europe, to above €0,30/kWh in western Europe. **In 2025, the EU-27 average electricity price for consumers was €0,28/kWh**.

UNPACKING YOUR ENERGY BILL

While standard consumer energy prices steadily increase due to taxes, grid fees, and commercial margins, the basic cost of energy generation itself has steadily decreased. This growing divergence — "the price wedge" — offers a critical opportunity for PEDs to deliver competitive value.

Thanks to renewable technology advances, process efficiencies, and economies for scale effects, the baseline cost of generating electricity now sits at roughly €0,07/kWh. Yet, the average EU consumer price hovers around €0,28/kWh — a three- to four-fold markup (see figure 3 below).

This steep retail markup is driven by grid network costs (adding roughly €0,06/kWh) and national taxes, which vary heavily by policy but typically range from €0,07/kWh (e.g. Hungary) to €0,17/kWh (e.g. Denmark).[1]

Single-family homeowners with individual rooftop solar already exploit this price difference. Because behind-the-meter self-consumption is not classified as a commercial economic activity, it bypasses grid fees and retail taxes entirely, bringing the final cost of home energy down to roughly €0,10/kWh (*relevant EU policy: Renewable Energy Directive (RED II - Directive (EU) 2018/2001) - later updated to 2023/2413*).

"Around €584bn investment in Europe's electricity grids will be needed this decade alone… without timely action, the cost of an under-invested grid risks being passed on to consumers through higher network tariffs and energy bills."

European Commission,
EU Action Plan for Grids

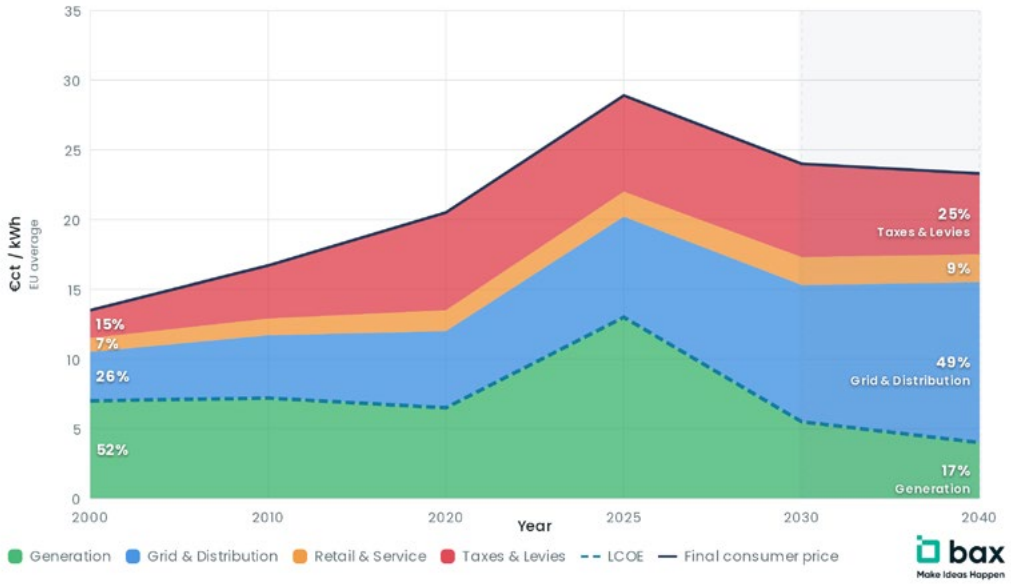
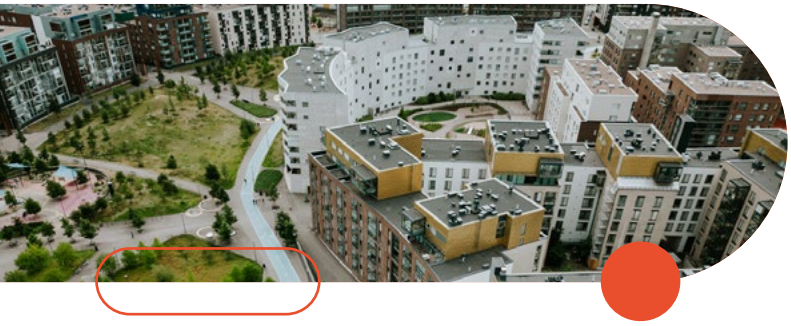


Figure 3: PEDs can leverage the decreasing cost of clean energy generation, whilst supportive policy already allows grid fee and tax exemptions in some regions (Data source: *Eurostat, EC DG ENER).*

[1] Eurostat (2026) EU household electricity prices stable in 2025. News article, 5 May. European Commission. Available at: https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20260505-1

The local energy advantage: While grid energy is subject to compounding market inflation — where a modest 2% annual price increase inflates total costs by 64% over 25 years — local renewable energy costs remain immune, fixed over a 25-year asset lifetime, anchored entirely to the initial technology depreciation.

The fundamental challenge — and a primary innovation frontier for PEDs — is to make this economic opportunity available for the urban majority, and not just those able to participate in hyperlocal energy community governance processes.



THE FUTURE OF ENERGY IS AT DISTRICT LEVEL

To evaluate the true market potential of PEDs compared to other energy supply alternatives, the "**Local Levelized Cost of Energy**" (LLCOE) is proposed as a possible metric and standard. Rather than viewing urban energy through technical indicators alone, the LLCOE (€ per kWh) allows citizens, developers, and policymakers to directly compare competing energy supply models.[2]

LLCOE accounts for how different energy supply options reflect their associated political and economic conditions. Using LLCOE, an energy bill can be disaggregated by its individual cost components such as generation capital costs, distribution fees, organization and administrative time, and taxation. By pinpointing exactly where the financial bottleneck lies in a given context, cities can identify the precise policy, economic, and organizational innovations required to drive down the PED price and secure its competitive advantage.

A competitiveness comparison of different energy supply models by system size and final estimated energy costs shows that:

Source	LLCOE (€/kWh)	Description
NZEBs	€0,19	The lowest energy prices can be achieved in detached NZEB (Nearly Zero-Energy Building). However, in dense urban settings individual buildings are unable to generate sufficient energy in relation to the number of consumers.
Grid	€0,29	Cheap green energy can be supplied to all consumers through socialised grids in Europe. However, this generally has a high (and growing) final energy price due to the associated taxes, commercial margins, and system costs.
PEDs	€0,10-0,15	Between single buildings and grid, intermediate levels of consumer i.e. "Districts", is where energy systems can be both more affordable than grids, as well as green, locally owned, and offering regional resilience. Dependent on local factors, the PEDs LLCOE will tend towards the depreciation cost of the technology stack.

[2] Bastiaanssen, Rolf and Sučić, Boris, Assessing Cost-Effectiveness of Local Energy Systems in Decentralized Energy Markets: The Metric Local Levelised Cost of Energy. Available at SSRN: http://dx.doi.org/10.2139/ssrn.5070955

RECOMMENDED PATHWAYS

City support for Positive Energy Districts (PEDs) should recognise and build on the latest innovations within the local energy sector – namely evolving from a focus on technical feasibility towards economic and societal viability. With first generation urban pilots now having demonstrated that "We can build PEDs", leading European cities should now demonstrate that "We can make people want them".

The following priorities towards city authorities are proposed to more effectively facilitate economically competitive PED offerings:

Communicate concrete benefits for citizens

Cities should communicate PEDs through the concrete benefits that citizens already understand and value, rather than through complex technical terminology.

As shared by PED project experts within this Knowledge Hub, typical citizens respond most strongly to the prospect of **lower energy bills**, **greater price stability**, and **improved resilience to external energy shocks**. Meanwhile, the term "positive energy district" remains technocratic, complex, and alienating to create broad, mass market engagement. Cities should therefore frame PED-related initiatives around clear household value propositions: reducing monthly costs, increasing local energy self-reliance, and protecting residents from future volatility.

To strengthen participation, cities should also connect PEDs to wider overlapping local concerns such as housing affordability and community resilience, making the initiative feel practical, relevant, and beneficial for citizens' daily lives.

The DUT *HeatCoop* project offers an interesting example of this overlapped approach, adapting the model of cooperative housing to reduce the financial and governance barriers to rolling out low-carbon district heating across apartments in Austria, Czech Republic, and Slovenia.[3]

Advocate for regulations that support PEDs and energy sharing

The European Mission on climate neutral cities follows the "mission oriented" approach introduced by Prof. Mariana Mazzucato. Mazzucato advocates that governments should actively shape and create markets to deliver societally optimal outcomes. She proposes that "innovation is political", and that achieving Europe's climate transition will be the result of proactive and value-driven political advocacy, rather than pure market logic.

Cities should recognise that they play a pivotal role within multi-level governance frameworks, being close to citizen and SMEs interests, while also having political legitimacy and voice to advocate for change at the macro regulatory level. Demonstrating which PED innovations are currently impossible under current regulations, and which outcomes would be possible under new policy, is a valuable and often overlooked role for cities.

For example, energy sharing (under collective self-consumption policy) is a policy tool with massive potential to expand the affordability of local clean energy to not just those who own the energy systems, but their neighbours too.

"To achieve mass-market uptake, PEDs need to be framed not as a technical ideal but as a pathway to affordability, resilience, and local economic value."

Daniele Vettorato,
EURAC, 4A4PEDs project

[3] https://dutpartnership.eu/projects/heatcoop



This position paper synthesises the insights from 10 PED experts working to advance DUT's Positive Energy District Transition Pathway (PED TP). The content was developed through three separate meetings and the use of a collaborative MIRO board across Q2/Q3 2026, where economic trends from Europe's energy sector were combined with concrete observations from DUT's PED projects. The authors led the writing structure and process. Co-authors and contributors reviewed the output and provided statements. Selective use of AI tools has been used to synthesise content from the discussions.

The publication content is the authors' own and does not necessarily represent the views of DUT.

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