Call Secretariat
JPI Urban Europe – PED Call

JPI Urban Europe
Final Report for the General Public
Positive Energy Districts and Neighbourhoods for Climate Neutrality (PED Call)

1. KEY DATA OF THE PROJECT

SHORT TITLE	TRANS-PED
LONG TITLE	Transforming Cities through Positive Energy Districts
PROJECT NUMBER	36776900
PROJECT PERIOD	01.04.2021 to 31.03.2023
PROJECT WEBSITE	trans-ped.eu
KEYWORDS	sustainable transformations, energy innovations, governance, co-production, learning

2. EXECUTIVE SUMMARY

Positive energy districts are an increasingly popular approach to transform how energy is produced, distributed, and consumed. They have the potential to play a significant role in achieving long-term decarbonisation goals. Changing energy systems requires innovations in technical and social systems that involve all energy system stakeholders. The TRANS-PED project recognised governance as a key challenge to support the further development of positive energy districts. The project team devised a collaborative approach for public, private, and third sector organisations in Sweden, Belgium, and Austria to engage with the general public. The approach is useful for identifying challenges and developing solutions for district-scale energy systems. The project produced a set of tools and insights to connect positive energy districts to broader urban sustainability aims of economic prosperity, environmental protection, and social equity. The project findings will inform the long-term realisation of positive energy districts in Europe and throughout the world.

3. PROJECT PARTNERS

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4. SUMMARY OF THE CONTEXT AND OVERALL OBJECTIVES OF THE PROJECT

Urban energy systems are in urgent need of transformation to realise decarbonisation goals while also creating cities that are more efficient, flexible, and self-sustaining. Cities are significant sources of global carbon emissions and serve as critical platforms to develop and implement far-reaching decarbonisation solutions. Urban energy transformations are currently being developed and realised through urban labs, living labs, transition labs, testbeds, and other experimental set-ups. Positive energy districts (PEDs) are a particularly promising approach to realise energy transformations rapidly and comprehensively.

A significant challenge to the successful rollout of PEDs in the coming decades is the lack of effective modes of governance. PEDs are celebrated for their achievements as demonstration projects but often fail to translate these achievements into comprehensive and widespread sustainable transformations. This reflects the broader trend of urban experimentation that has largely failed to convert the enthusiasm and goodwill of experimental actors into long-term systemic changes. By definition, PEDs require site-specific strategies to successfully navigate their particular institutional, spatial, regulatory, and cultural conditions. Meanwhile, the assessment of their performance is often limited to a narrow set of energy parameters while overlooking the broader characteristics related to neighbourhood service provision, economic productivity, and social well-being. Finally, PED proponents encounter significant challenges in their attempts to upscale their achievements to influence broader processes of sustainable urban transformation. To address these challenges, PEDs require holistic approaches to governance that are informed by strategic and effective collaboration among technical, economic, regulatory, and civil society stakeholders.

To address the multifaceted governance challenges of PEDs, the TRANS-PED project developed and engaged in co-production processes to support urban transformative capacity building. Urban transformative capacity is defined as ‘the collective ability of the stakeholders involved in urban development to conceive of, prepare for, initiate and perform path-deviant change towards sustainability within and across complex systems that constitute the cities they relate to.’[1] This requires new modes of collaboration between multiple stakeholders to construct and enact alternative pathways of urban development. It is through collaborative action and learning that deep and lasting changes to energy systems and the built environment can be realised. This collaborative governance approach is informed by the sociotechnical studies of cities and builds upon contemporary activities related to urban experiments and laboratories, sustainable transitions, and resilience planning. PEDs provide an ideal vehicle to develop urban transformative capacity because they involve bounded, multi-actor, real-world interventions that draw upon formal and informal expertise as well as theoretical and practical insights. The goal of developing urban transformative capacity is not to define a singular, universal approach to PEDs and sustainable cities but rather to leverage and integrate a heterogeneity of knowledges to create multiple pathways towards low-carbon urban futures.

[1] Wolfram, M. 2016. Conceptualizing urban transformative capacity: a framework for research and policy. *Cities 51:* 121–130.

The project team developed urban transformative capacity through participatory action research with PED stakeholders in Sweden, Belgium, and Austria. The project partners developed conceptual and practical tools to reimagine neighbourhood energy planning and governance using reflexive processes of co-learning. The stakeholders engaged in an active community of practice and learning through online and in-person workshops, site visits, and an interactive online engagement platform to co-create an effective governance approach to PEDs. They focused their work on four dimensions of PED governance that are critical to the development of urban transformative capacity:

1. Framing involves developing a shared conceptual understanding of how PEDs are envisioned, enacted and managed over time;
2. Embedding recognises the need to situate energy innovations within specific regulatory, spatial, and social contexts;
3. Assessing focuses on evaluating and monitoring energy interventions to assess their quantitative and qualitative performance as well as unintended effects and risks; and
4. Upscaling promotes the deliberate translation of lessons learned to enact wider systemic transformations through processes of growing, replicating, accumulating, and transforming.

The project team developed these four dimensions of PED governance through collaborative real-world engagements in the following established and aspirational PEDs:

1. Abattoir (Brussels, Belgium)
2. Brunnshög (Lund, Sweden)
3. Graz Reininghaus (Graz, Austria)
4. Hammarby Sjöstad (Stockholm, Sweden)
5. Sonnendorf (Tyrol, Austria)

The project was rooted in hands-on practices in the five PEDs that provided a platform for practitioners, city officials, academics, and citizens to co-produce knowledge about framing, embedding, assessing, and upscaling PEDs in specific contexts. The stakeholders collaborated inwardly to develop a governance approach specific to their particular PED and then collaborate outwardly to develop a suite of tools to assess the impacts of PED interventions and to successfully upscale the results and transfer them to other places. The findings were disseminated through publications and events. All project activities were designed to inform decision-making processes of PED design, development, and operations, and are relevant to policymakers, practitioners, and end users in Europe as well as globally. Ultimately, the project findings can be used to develop effective and long-term approaches to building urban transformative capacity through the development of an engaged community of practice and learning.

5. WORK PERFORMED AND MAIN RESULTS ACHIEVED

The project team conducted a transversal comparison of the five PEDs through an iterative process of interactive workshops and site visits to identify existing opportunities and barriers, and to devise solutions that can be adapted to other PEDs. The partners developed context-rich case studies of the five PEDs as well as toolkits and approaches that can be used to support the development of PED governance in other locales. The project combined the real-world embeddedness with the reflexive attitude promoted through participatory action research and developed reflexive interdisciplinary and transdisciplinary learning processes to support knowledge-intensive forms of urban innovation.

The key activities of the project were completed through six work packages (WPs) to provide a clear and logical progression of activities during 24 months of intensive collaboration. Two of the WPs (Managing & Communicating and Disseminating) involved continuous tasks over the duration of the project while the remaining WPs were executed in sequence to serve as iterative learning loops for the project partners. The WP activities were informed by synergistic themes of co-production and learning to utilise the expertise and experience of the project partners and PED stakeholders to produce a dynamic community of practice. A key aspect of the project structure was to maximise collaboration and knowledge exchange among all partners. The team sub-contracted a co-production organisation (Confluences asbl) to support a collaborative environment of mutual learning across all project activities. The objectives and outputs of each WP are summarised in the following paragraphs.

Managing & Communicating

Collaborative projects require a deliberate and clear management approach to ensure that project activities and deliverables are completed in a timely manner. The objective of this WP was to develop an efficient management approach for the project as a whole and an online platform to facilitate communication and collaboration among the project partners.

The outputs of this WP include:

- Online Collaboration Platform: an internal online hub where the project partners could connect, share, and co-produce knowledge
- Project Management Plan: a framework to support effective exchange and collaboration that included a governance structure, management structure, meeting and reporting protocols, communication strategy, dissemination strategy, monitoring and evaluation protocol, and data management strategy

Framing

All PEDs share general goals of situated energy innovation but vary significantly in how they interpret and combine concepts related to sustainability, transition, innovation, and so on. Likewise, PEDs are bounded sites of innovation that are highly diverse in terms of governance structures, stakeholder landscapes, physical and spatial conditions, urban planning and design policies, and energy/climate policies and regulations. Comparing and contrasting PED characteristics and approaches requires a common understanding of key terms as well as a shared methodological approach to guide knowledge co-production and

learning. The objective of this WP was to develop a common conceptual framework of PED characteristics and a shared methodology for PED co-production.

The outputs of this WP include:

- PED Typology Framework: a report that draws upon theories and practices of urban energy innovation to create a foundation for the analysis of PED characteristics, functions, and innovations and to facilitate transversal comparison across PEDs
- TRANS-PED Co-Production Toolbox: an interactive, online resource that summarises methods from participatory action research to support co-production processes
- Success Factors and Challenges of Positive Energy Districts in Europe: a report that identifies the success factors and challenges of current PEDs and characterises how PED stakeholders achieve their goals

Embedding

Urban innovations are embedded within specific historical, geographic, institutional, and cultural contexts. The situated characteristics of each PED have a significant influence on their approach and achievements. Relatedly, each PED is actively developing context-specific approaches that leverage opportunities to overcome barriers. The objective of this WP was to develop detailed case studies of the contextual characteristics and development strategies of the 5 PEDs.

The outputs of this WP include:

- PED Case Study Template: a comparative framework that includes five dimensions of PEDs including time, space, social, energy & other metabolic flows, and governance & policy context
- PED Case Studies: extended descriptions and analyses of the five PEDs, with specific insights on their historical development and their unique approaches to energy innovation
- Transversal Analysis of Five PEDs: A comparison of the similarities and differences between the five PEDs to highlight the diversity of ways that PEDs are realised in practice

Assessing

PEDs involve the introduction of novel socio-technical configurations and it is crucial to assess their performance both quantitatively and qualitatively. Assessment not only provides valuable insights on how a PED is achieving its technical, environmental, economic, and social goals but also creates critical opportunities for reflexive learning. It is through assessment that a PED can be continually appraised and iterated and reveal what is feasible and useful while also revealing knock-on effects, risks, and opportunities. The objective of this WP was to develop a shared PED assessment approach based on responsible innovation and existing performance parameters. The project team developed tools and insights to enable a responsible and reflective assessment of PED innovation measures.

The outputs of this WP include:

- Quick Guide to Responsible Research and Innovation in PEDs: a brief summary of how reflective learning practices can be used by PED practitioners to ensure that innovation processes address social and ecological goals
- Report on Responsible Innovation in PEDs: a report that emphasises the relevance of second-order learning processes to PED development and urban transformations and the importance of 'moments of reflection' to foster second-order learning in PEDs
- Responsible Innovation In and For PEDs: an extended framework for PED practitioners to critically question, reflect and share their experiences of PED development
- Catalogue of Assessment Parameters and Methods: a summary of the numerous assessment parameters and methods established in previous energy innovation projects and programmes
- PED Assessment Toolbox: a presentation of lesser-known assessment methods and approaches and how they can be applied to PEDs

Upscaling

Realising situated socio-technical innovation is a primary aim of all PEDs but it is also necessary to move beyond PED boundaries to support urban transformative capacity. Upscaling raises fundamental issues about how knowledge travels and is translated and applied in other contexts and recognises multiple tensions between place-based priorities and actions versus broader transformations. This requires learning processes which are not only broad, but deep, multi-layered and reflexive, including both first and second order learning (e.g. user context, regulation, societal impact). This WP recognised the need to move beyond individual cases by developing a portfolio of growth, replication, networking, and linking approaches to upscale PED findings to inform widespread urban transformations.

The output of this WP includes:

- Upscaling, Growth, and Replication of PEDs: a synthesis of key insights from the project partners about the opportunities and barriers to transfer PED-specific knowledge to other locales and have a broader impact on change processes

Disseminating

The project was designed to produce useful knowledge that can be accessed and used by a broad range of stakeholders to enhance the development of aspirational and established PEDs while also informing sustainable transformation processes more generally. Dissemination of project findings is a key to initiating and supporting a community of practice to build up urban transformative capacity. The project team engaged in multiple dissemination tasks to amplify and enhance the outputs described in the previous WPs and to maximise the impacts of the project as a whole.

The outputs of this WP include:

- Project Website: a publicly accessible archive of project outputs
- LinkedIn Group: an online network where PED practitioners share updates about their latest activities and outputs
- International events: Multiple presentations at practitioner and academic workshops and conferences to deliver the findings of the project and engage with PED stakeholders

6. PROGRESS BEYOND THE STATE OF THE ART AND EXPECTED POTENTIAL IMPACT

The TRANS-PED project included several innovations that went beyond the state of the art. This included a transdisciplinary approach to engage with all PED stakeholders, a focus on holistic and situated knowledge production activities, and an emphasis on actionable knowledge to inform urban transformations. These ideas are addressed in the following paragraphs along with reflections on the long-term impacts of the project.

The applied research focus of the project was used to establish a transnational community of practice around sustainable urban transformations. The project leveraged the principles of co-production and learning to foster useful knowledge to influence policy and interventions. The project team framed PEDs as catalysts for deep and fundamental changes to urban and regional development dynamics. The work was informed by previous JPI Urban Europe projects, that involved the governance of urban laboratories (URB@exp), the nurturing of collective capabilities (CAPA.CITY), the promises and challenges of living labs (GUST), and the importance of learning to collective decision-making (LOOPER).

The holistic approach to PED development required interdisciplinary as well as transdisciplinary engagement to be successful. The project team was interdisciplinary and included social scientists and engineers with expertise and experience in energy systems, urban planning and policy, community engagement and participation, and urban innovation and transformations. The researchers shared a sociotechnical perspective on urban governance that recognises energy technologies as indelibly connected to their social and material contexts. The researchers were complemented with stakeholders from the public, private, and third sectors with diverse practice-based experience in urban design and development, co-production, economic development, and outreach and knowledge sharing. The combination of researchers and practitioners comprised a transdisciplinary team of PED stakeholders who were committed to co-production and learning. Beyond the project team, the project engaged an extended network of co-operative partners from the public, private, and third sectors as well as the research community that served as a bridge to the global community of PED stakeholders.

The project team embraced a holistic approach to PED implementation and recognised that PED functions (specifically energy generation, efficiency, and flexibility) are components of larger processes of sustainable urban transformation. Designing and implementing energy innovations at the district scale provide a manageable and delineated space of strategic action. At the same time, each district had unique contextual characteristics that required

customised interventions to conform to particular physical, social, economic, and political constraints. Such a holistic approach recognises that energy is not independent but indelibly connected to broader urban development dynamics.

The project team emphasised the importance of learning as a key activity in PED development processes and created a range of methods to support learning. This included a comprehensive inventory of the most important performance indicators and monitoring methods carried out as well as new assessment methods that are customised for PEDs. Successful urban transformations, however, not only rely on optimising existing processes, but also require extended scrutiny of selected technical solutions and social arrangements. In other words, PEDs are not only about technological innovation but about social innovation. It is necessary to consider alternatives, to learn from positive and negative experiences and to develop general recommendations that contribute to a PED's development while also being relevant to similar processes in other PEDs. These methods, tools, and procedures can be used by PED practitioners in the future to support their work.

Ultimately, the project activities were oriented to produce actionable knowledge that is relevant to the five PEDs while providing additional tools and techniques for existing and aspirational PEDs across Europe and around the world. The activities produced new collaborations between the five PEDs as well as new funded research projects for future activities. The project outputs comprise a common pool of knowledge to support the SET Plan ambitions to establish 100 PEDs across Europe by 2025.[2] Moreover, the project serves as a model for PED research and practice while positioning Europe as a driving force for governing the transformation to decarbonised and liveable cities. The project is directly relevant to the United Nations' Sustainable Development Goals (SDGs), specifically Goal 7 (Clean and Affordable Energy), Goal 9 (Industry Innovation and infrastructure) and Goal 11 (Sustainable Cities and Communities). The capacity to learn from experience and experiments through various combinations of situated learning and upscaling constitutes a key driver in the pursuit of more sustainable urban futures.

7. OUTLOOK

PEDs will continue to be an important vehicle to achieve urban transformations in the coming decades. The following key insights from the TRANS-PED project can be used to enhance these activities.

PED Development as a Long-Term Process

Achieving PED goals requires extended commitment by all stakeholders. The project team established a strong foundation for collective action in each of the 5 PEDs over the last 24 months and these processes will continue to evolve as local stakeholders engage in a wide range of energy innovation activities. However, maintaining enthusiasm and drive over a long period of time is a key challenge for PED practitioners. This includes during design and construction phases as well as after the PED is inhabited and in operation. It is essential for

[2] https://jpi-urbaneurope.eu/wp-content/uploads/2021/10/setplan_smartcities_implementationplan-2.pdf

these collaborations to be inspired by clear, coherent, and shared visions that includes concrete objectives that can be continuously updated to leverage complementarities and synergies. The project team found that it is important to think about PEDs as a process rather than an end state and focus on the integration of technical and social innovation activities to create a cohesive district.

Embedding Energy Innovations in Specific Contexts

PEDs are a form of situated energy innovation and PED strategies need to be customised to fit within a specific context. The five PEDs in this project have significant differences with respect to social, cultural, political, and material conditions and this has a strong influence when selecting which energy innovations are appropriate and viable. Meanwhile, the PED concept is closely related to transportation, water and wastewater, work and home life, resource consumption, and so on. Energy is an important part of the broader combination of district processes that influence sustainability goals. Linking to other sustainability practices can help to deepen and extend the energy ambitions of PEDs.

Facilitating Co-Creation Processes

PEDs involve a 'whole system perspective' that requires input and engagement from all stakeholders. Working with stakeholders from the public sector, private sector, academia and civil society is challenging and time-consuming but also rewarding. A PED intermediary can help to introduce and curate co-creation processes involving heterogenous groups. The intermediary is responsible for motivating, engaging, and empowering the various stakeholders while also ensuring that the long-term visions are being addressed through various activities.

The Importance of PED Performance

PEDs need to be assessed on a regular basis to ensure that they are achieving their stated goals. This requires the development of baseline information as well as dedicated measurement and analysis of quantitative and qualitative parameters to characterise PED performance. Most PED evaluations focus on optimising and improving systems (also known as 'first-order learning') and this needs to be complemented with broader reflections on the consequences of sociotechnical innovation ('second-order learning'). Second-order learning can be used to upscale PED activities and realise broader changes in other places. Upscaling is often an afterthought of situated energy innovation but needs to be planned from the start and can include replication, knowledge sharing, adoption of more stringent performance goals, and other ideas.

Mainstreaming the PED Approach

In the long-term, there is a need to mainstream the PED approach. The goal of realising 100 PEDs in European cities in the next few years is a promising start. Upscaling, intensification, replication, and amplification processes can be used to transfer the learnings from PED projects into broader energy innovation processes and urban development dynamics. This will require enabling different concepts and development paths while not losing sight of the ambitious goals that go far beyond the field of energy.