



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

ARCHIVIO ISTITUZIONALE DELLA RICERCA

Alma Mater Studiorum Università di Bologna Archivio istituzionale della ricerca

Energy Citizenship. Tools and Technologies to enable Transition in Districts = Cittadinanza energetica.
Strumenti e tecnologie per abilitare la transizione nei distretti

This is the final peer-reviewed author's accepted manuscript (postprint) of the following publication:

Published Version:

Availability:

This version is available at: <https://hdl.handle.net/11585/913234> since: 2023-01-31

Published:

DOI: <http://doi.org/10.36253/techne-13721>

Terms of use:

Some rights reserved. The terms and conditions for the reuse of this version of the manuscript are specified in the publishing policy. For all terms of use and more information see the publisher's website.

This item was downloaded from IRIS Università di Bologna (<https://cris.unibo.it/>).
When citing, please refer to the published version.

(Article begins on next page)

This is the final peer-reviewed accepted manuscript of:

Longo, D., Boulanger, S. O. M., Massari, M., & Turci, G. (2023). Energy citizenship. Tools and technologies to enable transition in districts = Cittadinanza energetica. Strumenti e tecnologie per abilitare la transizione nei distretti. *TECHNE - Journal of Technology for Architecture and Environment*, (25), 84–92

The final published version is available online at: <https://doi.org/10.36253/techne-13721>

Terms of use:

Some rights reserved. The terms and conditions for the reuse of this version of the manuscript are specified in the publishing policy. For all terms of use and more information see the publisher's website.

This item was downloaded from IRIS Università di Bologna (<https://cris.unibo.it/>)

When citing, please refer to the published version.

Energy Citizenship. Tools and Technologies to enable Transition in Districts

Danila Longo¹, <https://orcid.org/0000-0002-7516-7556>

Saveria Olga Murielle Boulanger¹, <https://orcid.org/0000-0003-2147-3192>

Martina Massari¹, <https://orcid.org/0000-0002-5483-5869>

Giulia Turci¹, <https://orcid.org/0000-0003-0930-0838>

¹ Department of Architecture, Università di Bologna, Italy

Primary Contact: Danila Longo, danila.longo@unibo.it

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record.

Published: October 22, 2022

DOI: 10.36253/techne-13721

Abstract

Responses to the current energy crisis and to action against climate change have produced a wide variety of experimentations. Positive Energy Districts (PEDs) and Energy Communities (EC) are spreading as aggregators of enabling technologies, but the knowledge and skills needed to plan, implement and monitor them still need to be developed. Technology alone is not enough to facilitate knowledge sharing and solutions experimentation and co-creation. The contribution focuses on methods and tools that allow supporting the creation of "energy citizens", through the considerations developed in the project H2020 GRETA (Green Energy Transition Actions) and in the COST Action 'PED-EU-NET'.

Keywords: energy citizenship; Positive Energy Districts (PEDs); climate neutrality; energy transition; community.

Please cite this article as:

Longo, D., Boulanger, S.O.M., Massari, M., Turci, G. (2022). Energy Citizenship. Tools and Technologies to enable Transition in Districts / Cittadinanza energetica. Strumenti e tecnologie per abilitare la transizione nei distretti. *Techne. Journal of Technology for Architecture and Environment*, Just Accepted.

Introduction

European strategic planning needs to significantly accelerate energy and environmental policies and favour the implementation of wide-ranging actions that have effective, immediate and long-term impacts (European Commission, 2019b). This is confirmed by the latest IPCC reports (Intergovernmental Panel on Climate Change)(IPCC, 2022a, 2022b) but also by the most recent socio-political-economic events that are putting a strain on the applicability (and popularity) of environmental strategies in the face of the serious energy emergencies caused by the war in Ukraine.

Cities need effective and shared strategies for the transition toward climate neutrality also by accelerating the use of technological frontiers. At the same time, it is clear that technological implementation alone is not enough: the involvement of citizenship and, above all, an active, informed and unanimous citizenship is necessary (European Commission, 2019a). At the same time,

the dialogue around technical processes, such as energy use and consumption, appears complex. The reasons are to be found in the technical and operational difficulty of the energy issue, but also in the lack of openness of the data relating to its production, use and consumption, for both market and political reasons.

If the citizen's involvement takes place more widely with respect to domestic consumption, the activation of group dynamics, the understanding of highly technological networks, such as smart grids, and the involvement of individuals in self-consumption and energy production multi-actor processes are only recently pursued. Energy Communities (CE) but also the most innovative Positive Energy Districts (PEDs) are moving in this direction. In the EU, in fact, this type of technologically advanced solution for energy-performing urban districts, together with solutions for the creation of energy communities of mutual exchange between citizens and businesses, and strategies for the inclusion of individuals in broad processes that involve not only end users but also producers, municipalities and large and medium-sized companies are being developed.

In this context, some research is positioned to understand how energy citizenship can be developed and supported over time. This article aims to contribute to this line of research, presenting and proposing some tools, strategies and reflections derived from two projects funded by the European Commission: GRETA (GReen Energy Transition Actions; GA101022317) e la COST Action 'Positive Energy District European Network'. La ricerca mira, infatti, a evidenziare alcuni possibili strumenti di coinvolgimento dei cittadini.

The contribution is divided into 5 sections. The first proposes a qualitative review of the reference literature for energy citizenship and PED issues; the second defines research methodologies; the third and fourth propose operational tools respectively in PEDs cases and in a real case identified in a large area of Bologna city. Finally, the fifth section proposes some reflections and future research lines.

Energy citizenship in Europe: a theme to be clarified in its relationship with innovative technologies

Energy citizenship is a fairly recent concept, emerging at the turn of the years 2004-2010 as a European and global energy transition key theme. A search on Google Scholar shows that until 2004-2005 there were almost no articles mentioning the concept, except for (Devine-Wright, P., 2004), considered the first article approaching the theme. Between 2006 and 2010 there are 38 articles addressing the issue, although the phrase "energy citizenship" tends not to appear in the headlines. From the addressed analysis, Devine-Wright (Devine-Wright, 2006; Walker and Devine-Wright, 2008) appears to be a pioneer in research on the subject. A more important presence of the phrase, especially in the titles, takes place in the following five years (2011-2015), when there are 135 articles are found on the subject. This growing attention is confirmed in the following periods: in 2016 and 2020, 377 articles appear on the subject and in the last two years 2021-2022, 364. This brief review confirms how energy citizenship is meeting a growing interest and how there is an urgency in identifying methodologies and strategies for greater involvement of civil society in the energy transition (European Commission, 2019a; Schlindwein and Montalvo, 2022; Schot, J. et al., 2016).

The concept of "energy citizenship", in fact, refers to the concept of active involvement of non-specialized people within a complex system such as the energy one. Active involvement generally means the presence of voluntary, direct and concrete actions that citizens operate within the energy sector. According to several authors, the inclusion of citizens in decision-making processes related to the energy system influences the more general community response to innovations and interventions in the sector and supports a better acceptance of decarbonization solutions (Schlindwein and Montalvo, 2022; Sovacool et al., 2020).

Although the phrase "energy citizenship" is only one of the most recent (recall, for example, the phrases "performative citizenship" or "sustainable citizenship" or "energy democracy"), the juxtaposition of the term "citizen" with "energy" highlights a precise connection between the rights and duties of the individual and the energy itself. Devine-Wright affirms how the public is conceived

as an active part in energy system evolution and how its potential for action is framed by notions of fair law and responsibility throughout society to address energy consumption consequences, in particular related to climate change (Devine-Wright, P., 2004, p. 71). These aspects of law and responsibility are key elements of the definition since on the one hand, they define how energy must be a right of all; therefore, to be accessible to all those who live in a condition of citizenship (including the most economically fragile people), on the other hand how there is a responsibility of individuals in supporting a better management, consumption and production of the same at urban and territorial level (Olivadese et al., 2021; Wahlund and Palm, 2022).

Although the theme is widely spread in the scientific debate, a definitive and widely accepted definition seems not to be present, not only from its theoretical point of view, but above all from the operational one (Beauchampet and Walsh, 2021; Lennon et al., 2020; Schlindwein and Montalvo, 2022; Wahlund and Palm, 2022). An element that appears almost entirely missing is the relationship between the need to involve citizens in more active forms of participation in energy production and management and the technology necessary to act in this direction. In particular, two key innovations emerge in this direction, aimed at facilitating or regulating this type of interaction: Energy Communities and Positive Energy Districts or positive energy districts.

Energy Communities can generally be defined as groups of users (private, public or both) who are organized or self-organized to share energy (Boulanger et al., 2021; Rathnayaka et al., 2011). Recent European and Italian regulatory developments favour this type of grouping, which is the reason why several energy communities were born at the European level and are being born in Italy. Positive Energy Districts are configured as an innovative model of energy transition (Sareen et al., 2022). Introduced to the European scene by the Strategic Energy and Technology Plan (SET-Plan Working Group 3.2, 2018), are defined as energy-efficient and flexible urban areas that produce net-zero greenhouse gas emissions and actively manage annual local or regional renewable energy production (JPI Urban Europe, 2020, p. 4). The success of PEDs experiments is therefore closely linked to the adoption of locally specific and innovative technological solutions but also to their acceptance and participation by citizens (Cheng et al., 2022) and by all actors from the earliest planning stages (Ahlers et al., 2019).

Methodology e Objectives

The research was carried out using a qualitative methodology based on two parallel approaches:

- an updated state-of-the-art, with the identification of emerging tools and strategies referred to net-zero energy districts;
- study and testing of a tool (Community Transition Pathway) in a real context of Bologna city (Italy), where different transition strategies towards the creation of new energy communities and the preparation of a nearly zero energy district are underway.

Starting from this analysis, the aim of the contribution is to identify some possible strategic lines to support the technological and sustainable evolution in the neighbourhoods, through tools that help the communities themselves to be autonomous, informed and active.

Enabling tools for Positive Energy Districts

PEDs (Positive Energy Districts), as well as Energy Communities, are complex socio-technical infrastructures able to combine the technological component with environmental, social and economic aspects. Starting from the analysis of the literature and the main research projects currently ongoing in Europe, the most interesting tools aimed at facilitating the process of realization, replication and scalability of PEDs have been analysed. (Table 01).

The analysis allowed to identify three main categories of tools:

- Tools to facilitate knowledge: collections of case studies, projects, best practices and lessons learned that bring together experiences and innovative solutions facilitating the knowledge of the PED model. In particular, the Booklet of PEDs, developed by JPI Urban Europe, is structured as a collection of case studies in order to identify common characteristics, strategies, challenges and elements of success to guide stakeholders in PEDs implementation (Bossi et al., 2020). The

PED Database, currently under construction as part of the COST Action '*PED-EU-NET*' activities, in collaboration with Annex 83 e JPI UE initiatives, can be considered the digital format evolution of the *Booklet*. The *Database* will be structured as a real interoperable *open access* platform, where it is possible to explore and compare case studies, projects, initiatives, strategies, policies and solutions relevant to districts development (Turci et al., 2022). *PED Learning Community*, developed by the H2020 Atelier project, is an online platform that facilitates the knowledge of the PED concept through the systematization of information materials, video-lessons and workshops and through the promotion of networking activities involving citizens and experts ("Atelier project, *PED Learning Community Platform*," 2022).

- Tools to support stakeholder involvement: aim at facilitating the participation of stakeholders in the different stages of implementation of interventions at the district scale. The +CityxChange project, in the pilot cities of Limerick and Groningen, is working on the development of a shared model for participatory urban laboratories -Innovation Playgrounds - in which researchers, practitioners, municipalities, associations and citizens collaborate to test innovative solutions in PEDs (Mee et al., 2021). As part of the international Annex 83 'Positive Energy Districts' initiative, the study conducted by (Cheng et al., 2022) proposes to expand the PED Toolbox by developing a tool to map the stakeholders involved in the different stages of the PED implementation process.
- Tools to facilitate decision-making and implementation: these are mainly step-by-step methodologies that accompany the implementation of PEDs with a focus on the planning phase of the intervention. The research carried out by (Civiero et al., 2022, 2021) proposes an innovative simulation model, called PEDRERA, to support PED-based redevelopment actions to be applied in consolidated urban contexts. As part of the Making-City research project, a methodology is developed to accompany cities in the implementation of PEDs: starting from the study of urban components and the analysis of planning tools and energy demand, the most suitable area is identified and the strategies and actions to be taken are planned according to the social, economic and environmental conditions of the context in which the action is taken (Alpagut et al., 2019).

The Community Transition Pathway and its application in the context of the Pilastro district and Le Roveri area in Bologna

The Pilastro district and the Le Roveri industrial zone are two neighbouring areas of the peri-urban area in the northeast of the city of Bologna. Together they have a total extension of approximately 400 hectares with mixed functions. The northern area is mainly characterised by the residential area of Pilastro, while the southern area is predominantly an industrial area and hosts large, small and medium-sized enterprises from different sectors. The Pilastro district is particularly interesting from the perspective of the community and its history. It is an important experience of building a social housing district from scratch dating back to the 1960s. The motivations for its construction were to absorb the substantial migratory flows from southern Italy. Today the area appears relevant for research for several reasons such as the presence of a community (very mixed for cultures and incomes) with strong sense of belonging and associative participation; the presence of industries that need to find solutions for reducing energy consumption; the presence of one of the largest photovoltaic parks in Europe, on the roofs of CAAB, with a production of 11,350,000 Kw/h of primary energy.

Several research projects are active in the area, conducted by the University of Bologna, Department of Architecture, in partnership with other actors in the area. These include, in particular, the GECCO - Green Energy Community project, financed by EIT Climate-KIC (active from July 2019), which aims to create an energy community, and GRETA - GReen Energy Transition Actions, financed by the H2020 programme, which aims to enable a broad and active involvement of citizens in energy transition processes, formulating Community Transition Pathways aimed at guiding communities towards different levels of awareness regarding energy issues and decarbonisation objectives.

The Community Transition Pathways are an innovative tool built by the University of Bologna research group in collaboration with project partners and are designed as a platform to accompany communities in identifying and clarifying their goals related to energy transition and the establishment of innovative strategies such as energy communities or self-consumption groups. This tool is structured in several components, including a guide (canvas) to building transition scenarios and objectives and some suggestions for sharing and collaborating with local actors and the municipality. The tool was tested during several co-design meetings. The use of the canvas, in particular, allowed the community to:

- re-discuss internally and together with the researchers, the residents' community energy improvement objectives in the short, medium and long term;
- frame these objectives within broader strategic urban planning;
- build a hierarchy of actions, depending on the level of feasibility and speed or the need for negotiation with other actors in the area. The image (Fig.02) shows one of the canvases used and filled in at one of the community meetings.

Discussion and Conclusions

The increased accessibility of citizen communities to energy issues, offered by enabling technology aggregators such as PEDs and energy communities, represents an opportunity for growth and transition of territories. The research conducted confirms the role of technologies as drivers of energy transition, but only if accompanied by appropriate activities and tools to support local communities. From the projects presented, it emerges, albeit in different ways, how various models and tools for involvement already exist, but need to be properly used with communities. From the GRETA project, in particular, and the numerous meetings with the community, it is clear that the energy issue is complex, both from a technical, economic and management perspective. However, the CTP presented, coupled with the tutoring activities carried out by the researchers, highlights how a greater degree of understanding on the part of the citizenry is attainable, given a willingness to reciprocally exchange knowledge and a collective perspective reasoning. In this direction, the participation in the activities of the two projects presented, make it possible to highlight some points of reflection, useful to outline a research path on the accessibility of technologies (and of the aggregators that contain them) to accompany the energy transition of communities.

A first point concerns the knowledge and integration of multiple solutions. Energy communities and PEDs can be allies in the transition, with one emphasising the collaborative aspects at the community level and the other the most important technological innovations. Neither can avoid a situated knowledge of the specific territorial context and its population.

Another point concerns the involvement, awareness and empowerment of citizens in the transformations that affect them directly and indirectly. While on the one hand it is necessary to inspire a sense of responsibility and urgency, on the other hand it is important to understand the real barriers citizens have in implementing energy, economic, cultural, cognitive mitigation strategies. These must find concrete answers from a multidisciplinary transformation support team (energy support agencies, technical staff of administrations, alliances with universities).

A final point concerns the urgency of effective implementation of interventions, also in the form of pilot actions. Micro-scale, fast, reversible experiments make it possible to evaluate and observe the effectiveness of interventions, without requiring large investments or complex technologies. These, however, require the use of management tools and a framework shared by all actors.

Although far from being exhaustive, the contribution has highlighted a number of elements that have emerged from the research conducted to date. The originality lies mainly in the linking of enabling technology aggregators, such as energy communities and PEDs. The research emphasises how these two approaches must work synergistically in order to be considered as allies in the transition path.

Future applications of these focus points in ongoing research projects in the Bologna area may provide further developments and more in-depth discussion results based on more data.

References

- Ahlers, D., Driscoll, P., Wibe, H., Wyckmans, A., 2019. Co-Creation of Positive Energy Blocks. IOP Conf. Ser.: Earth Environ. Sci. 352, 012060. <https://doi.org/10.1088/1755-1315/352/1/012060>
- Alpagut, B., Akyürek, Ö., Mitre, E.M., 2019. Positive Energy Districts Methodology and Its Replication Potential. Proceedings 20, 8. <https://doi.org/10.3390/proceedings2019020008>
- Atelier project, PED Learning Community Platform [WWW Document], 2022. URL <https://www.pedlearning.eu/home> (accessed 9.2.22).
- Beauchampet, I., Walsh, B., 2021. Energy citizenship in the Netherlands: The complexities of public engagement in a large-scale energy transition. Energy Research & Social Science 76, 102056. <https://doi.org/10.1016/j.erss.2021.102056>
- Bossi, S., Gollner, C., Theierling, S., 2020. Towards 100 Positive Energy Districts in Europe: Preliminary Data Analysis of 61 European Cases. Energies 13, 6083. <https://doi.org/10.3390/en13226083>
- Boulanger, S.O.M., Massari, M., Longo, D., Turillazzi, B., Nucci, C.A., 2021. Designing Collaborative Energy Communities: A European Overview. Energies 14, 8226. <https://doi.org/10.3390/en14248226>
- Cheng, C., Albert-Seifried, V., Aelenei, L., Vandevyvere, H., Seco, O., Nuria Sánchez, M., Hukkala, M., 2022. A Systematic Approach Towards Mapping Stakeholders in Different Phases of PED Development—Extending the PED Toolbox, in: Littlewood, J.R., Howlett, R.J., Jain, L.C. (Eds.), Sustainability in Energy and Buildings 2021, Smart Innovation, Systems and Technologies. Springer, Singapore, pp. 447–463. https://doi.org/10.1007/978-981-16-6269-0_38
- Civiero, P., Pascual, J., Arcas Abella, J., Bilbao Figuero, A., Salom, J., 2021. PEDRERA. Positive Energy District Renovation Model for Large Scale Actions. Energies 14, 2833. <https://doi.org/10.3390/en14102833>
- Civiero, P., Pascual, J., Arcas Abella, J., Salom, J., 2022. Innovative PEDRERA Model Tool Boosting Sustainable and Feasible Renovation Programs at District Scale in Spain. Sustainability 14, 9672. <https://doi.org/10.3390/su14159672>
- Devine-Wright, P., 2004. Towards zero-carbon: Citizenship, responsibility and the public acceptability of sustainable energy technologies. Presented at the Proceedings of Conference C81 of the Solar Energy Society, UK section of the International Solar Energy Society, pp. 51–62.
- European Commission, 2019a. Orientations towards the first Strategic Plan for Horizon Europe. Directorate Research and Innovation.
- European Commission, 2019b. A European Green Deal [WWW Document]. European Commission - European Commission. URL https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en (accessed 7.20.22).
- IPCC, 2022a. Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press. ed. Cambridge.
- IPCC, 2022b. Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA.
- JPI Urban Europe, 2020. White Paper on PED Reference Framework for Positive Energy Districts and Neighbourhoods.
- Lennon, B., Dunphy, N., Gaffney, C., Revez, A., Mullally, G., O'Connor, P., 2020. Citizen or consumer? Reconsidering energy citizenship. Journal of Environmental Policy & Planning 22, 184–197. <https://doi.org/10.1080/1523908X.2019.1680277>
- Mee, A., Lyes, M., Crowe, P., 2021. Energy Urbanity and Active Citizen Participation. Energies 14, 6515. <https://doi.org/10.3390/en14206515>
- Olivadese, R., Alpagut, B., Revilla, B.P., Brouwer, J., Georgiadou, V., Woestenburger, A., van

- Wees, M., 2021. Towards Energy Citizenship for a Just and Inclusive Transition: Lessons Learned on Collaborative Approach of Positive Energy Districts from the EU Horizon2020 Smart Cities and Communities Projects. Proceedings 65, 20. <https://doi.org/10.3390/proceedings2020065020>
- Rathnayaka, A.J.D., Potdar, V.M., Hussain, O., Dillon, T., 2011. Identifying prosumer's energy sharing behaviours for forming optimal prosumer-communities, in: 2011 International Conference on Cloud and Service Computing. Presented at the 2011 International Conference on Cloud and Service Computing, pp. 199–206. <https://doi.org/10.1109/CSC.2011.6138520>
 - Sareen, S., Albert-Seifried, V., Aelenei, L., Reda, F., Etmnan, G., Andreucci, M.-B., Kuzmic, M., Maas, N., Seco, O., Civiero, P., Gohari, S., Hukkalainen, M., Neumann, H.-M., 2022. Ten questions concerning positive energy districts. Building and Environment 216, 109017. <https://doi.org/10.1016/j.buildenv.2022.109017>
 - Schindwein, L., Montalvo, C., 2022. Accounting for heterogenous behaviours within transformative policy-making: the case of Energy Citizenship.
 - Schot, J., Kanger, L., Verbong, G., 2016. The roles of users in shaping transitions to new energy systems | Nature Energy. Nature energy 1, 1–7.
 - SET-Plan Working Group 3.2, 2018. Europe to become a global role model in integrated, innovative solutions for the planning, deployment, and replication of Positive Energy Districts, SET-Plan Action No 3.2.
 - Sovacool, B.K., Turnheim, B., Martiskainen, M., Brown, D., Kivimaa, P., 2020. Guides or gatekeepers? Incumbent-oriented transition intermediaries in a low-carbon era. Energy Research & Social Science 66, 101490. <https://doi.org/10.1016/j.erss.2020.101490>
 - Turci, G., Alpagut, B., Civiero, P., Kuzmic, M., Pagliula, S., Massa, G., Albert-Seifried, V., Seco, O., Soutullo, S., 2022. A Comprehensive PED-Database for Mapping and Comparing Positive Energy Districts Experiences at European Level. Sustainability 14, 427. <https://doi.org/10.3390/su14010427>
 - Wahlund, M., Palm, J., 2022. The role of energy democracy and energy citizenship for participatory energy transitions: A comprehensive review. Energy Research & Social Science 87, 102482. <https://doi.org/10.1016/j.erss.2021.102482>

Images

Booklet of PEDs

Reference project: Positive Energy Districts and Neighbourhoods | **Funding programme:** JPI Urban Europe | **Realisation year:** 2020 | **Source:** https://jpi-urbaneurope.eu/wp-content/uploads/2020/06/PED-Booklet-Update-Feb-2020_2.pdf

Main Characteristics

Application scale:

Building District City

Application context:

New construction Renovation

Users target:

Citizens Municipalities Professionals/Researchers

Application phase:

Planning Implementation Monitoring

Case studies:

Yes - 29 PED-case studies e 32 PED-like case studies

Brief description

Scope

collecting and analysing a compilation of case studies of sustainable urbanization and energy transition at district scale.

Structure

divided into two sections: PED case studies and PED-like case studies. Each section is divided accordingly into already implemented cases, in implementation phase and in planning phase.

PED Database

Reference project: Positive Energy District European Network (PED-EU-NET) | **Funding programme:** COST Action | **Realisation year:** ongoing | **Source:** <https://pedeu.net/>

Main Characteristics

Application scale:

Building District City

Application context:

New construction Renovation

Users target:

Citizens Municipalities Professionals/Researchers

Application phase:

Planning Implementation Monitoring

Brief description

Scope

mapping existing concepts, strategies, projects, case studies, technological and non-technological solutions related to PEDs in Europe, to support municipalities through the decision-making process of PED implementation.

Structure

divided into Questionnaire 1 - contains sections A, B, C and describes PED Case studies and PED Labs – and into Questionnaire 2 - contains

<p>Case studies: Yes - constantly updating.</p>	<p>section D (Projects and Initiatives), Section E (National Policies and Strategies), section F (Technological/Non-Technological solutions).</p>
<p>PED Learning Community Platform</p>	
<p>Reference project: Atelier - AmstERdam BiLbao cltizen drivEn smaRt cities Funding programme: Horizon 2020 programme Realisation year: 2022 Source: https://www.pedlearning.eu/</p>	
<p>Main Characteristics <u>Application scale:</u> <input type="checkbox"/>Building <input checked="" type="checkbox"/>District <input type="checkbox"/>City <u>Application context:</u> <input checked="" type="checkbox"/>New construction <input checked="" type="checkbox"/>Renovation <u>Users target:</u> <input checked="" type="checkbox"/>Citizens <input checked="" type="checkbox"/>Municipalities <input checked="" type="checkbox"/>Professionals/Researchers <u>Application phase:</u> <input checked="" type="checkbox"/>Planning <input type="checkbox"/>Implementation <input type="checkbox"/>Monitoring <u>Case studies:</u> Amsterdam (NL)</p>	<p>Brief description <u>Scope</u> open access learning place for online e-learning and interaction between different users and experts to understand how to implement PEDs in different contexts. <u>Structure</u> divided in 3 sections: 'PED Start Guide' where PED concept is presented, 'Community' for the networking between users and for giving feedback on the platform interoperability and 'Best resources' where the information material related to the PEDs is collected.</p>
<p>Innovation Playground Framework</p>	
<p>Reference project: +CityxChange Funding programme: Horizon 2020 programme Realisation year: 2020 Source: https://cityxchange.eu/knowledge-base/d3-3-framework-for-innovation-playgrounds/</p>	
<p>Main Characteristics <u>Application scale:</u> <input type="checkbox"/>Building <input checked="" type="checkbox"/>District <input type="checkbox"/>City <u>Application context:</u> <input checked="" type="checkbox"/>New construction <input checked="" type="checkbox"/>Renovation <u>Users target:</u> <input checked="" type="checkbox"/>Citizens <input checked="" type="checkbox"/>Municipalities <input checked="" type="checkbox"/>Professionals/Researchers <u>Application phase:</u> <input checked="" type="checkbox"/>Planning <input checked="" type="checkbox"/>Implementation <input type="checkbox"/>Monitoring <u>Case studies:</u> Limerick (IR), Groningen (NL)</p>	<p>Brief description <u>Scope</u> framework that promotes an open innovation approach, based on the engagement of a wide range of stakeholders (quadruple helix model). <u>Structure</u> participatory laboratories structured around three key elements: 'System' – describing the elements that constitute the playgrounds (places, activities, data, enabling mechanism), 'Journey' – defining the steps that lead to Playground implementation and 'Localisation' – investigating PEDs implementation potentiality in the local context.</p>
<p>Stakeholders Mapping</p>	
<p>Reference project: Annex83 'Positive Energy Districts' Funding programme: IEA-EBC programme Realisation year: 2022 Source: https://link.springer.com/chapter/10.1007/978-981-16-6269-0_38</p>	
<p>Main Characteristics <u>Application scale:</u> <input type="checkbox"/>Building <input checked="" type="checkbox"/>District <input type="checkbox"/>City <u>Application context:</u> <input checked="" type="checkbox"/>New construction <input checked="" type="checkbox"/>Renovation <u>Users target:</u> <input type="checkbox"/>Citizens <input checked="" type="checkbox"/>Municipalities <input checked="" type="checkbox"/>Professionals/Researchers <u>Application phase:</u> <input checked="" type="checkbox"/>Planning <input checked="" type="checkbox"/>Implementation <input type="checkbox"/>Monitoring <u>Case studies:</u> N/A</p>	<p>Brief description <u>Scope</u> operational and systematic approach for mapping the stakeholders in the different PEDs development phases. <u>Structure</u> matrix composed of eight categories of actors involved in the distinct phases of project development (I. general planning of the intervention, II. energy planning, III. planning of the construction or redevelopment process, IV. implementation of the intervention, V. implementation phase, VI. monitoring, VII. post-intervention assessment) and subdivided by proximity levels (building, district and city).</p>
<p>PEDRERA. Positive Energy District renovation model</p>	
<p>Reference project: TECNIOSpring PLUS Funding programme: H2020 programme Marie Skłodowska-Curie Realisation year: 2021 Source: https://doi.org/10.3390/en14102832</p>	
<p>Main Characteristics <u>Application scale:</u> <input checked="" type="checkbox"/>Building <input checked="" type="checkbox"/>District <input type="checkbox"/>City <u>Application context:</u> <input type="checkbox"/>New construction <input checked="" type="checkbox"/>Renovation <u>Users target:</u> <input type="checkbox"/>Citizens <input checked="" type="checkbox"/>Municipalities <input checked="" type="checkbox"/>Professionals/Researchers <u>Application phase:</u> <input checked="" type="checkbox"/>Planning <input checked="" type="checkbox"/>Implementation <input checked="" type="checkbox"/>Monitoring <u>Case studies:</u> Barcelona, Palma de Maiorca (ES)</p>	<p>Brief description <u>Scope</u> multidimensional model aimed at promoting large-scale urban regeneration processes in Positive Energy District perspective. <u>Structure</u> step-by-step approach, structured as follows: step I - aggregation of data in 4 domains (business models, environmental issues, operational issues and social issues), step II - stakeholders mapping and definition of the main requirements, step III - definition of retrofit measures and cost analysis, step IV - priority KPIs evaluation and definition of possible scenarios, step V, step VI, step VII - realization of the intervention.</p>
<p>Methodology and guidelines for PED design</p>	
<p>Reference project: Making City Funding programme: H2020 programme Realisation year: 2020 Source: https://makingcity.eu/wp-content/uploads/2021/12/MakingCity_D4_1_Methodology_and_Guidelines_for_PED_design_final.pdf</p>	
<p>Main Characteristics <u>Application scale:</u> <input type="checkbox"/>Building <input checked="" type="checkbox"/>District <input checked="" type="checkbox"/>City <u>Application context:</u> <input checked="" type="checkbox"/>New construction <input checked="" type="checkbox"/>Renovation</p>	<p>Brief description <u>Scope</u> methodology for PED design aimed at identifying PED concept boundary and proper technical and non-technical actions for cities in their [step-by-step] pathway to energy transition <u>Structure</u></p>

Users target:

Citizens Municipalities Professionals/Researchers

Application phase:

Planning Implementation Monitoring

Case studies:

Groningen (NL) e Oulu (FI)

step-by-step approach, structured in six phases: phase I - city level indicators, analysis of planning tools, analysis of urban components, analysis of energy demand, phase II - definition of the area and definition of district limits, phase III/ IV - set of solution, potential barriers and enablers; phase V - calculation of energy balance, phase VI – PED Solution Cards with detailed information on the solutions to be implemented.

Tab. 01 - PED Enabling instruments



Fig. 01 - Photo of a GRETA project event

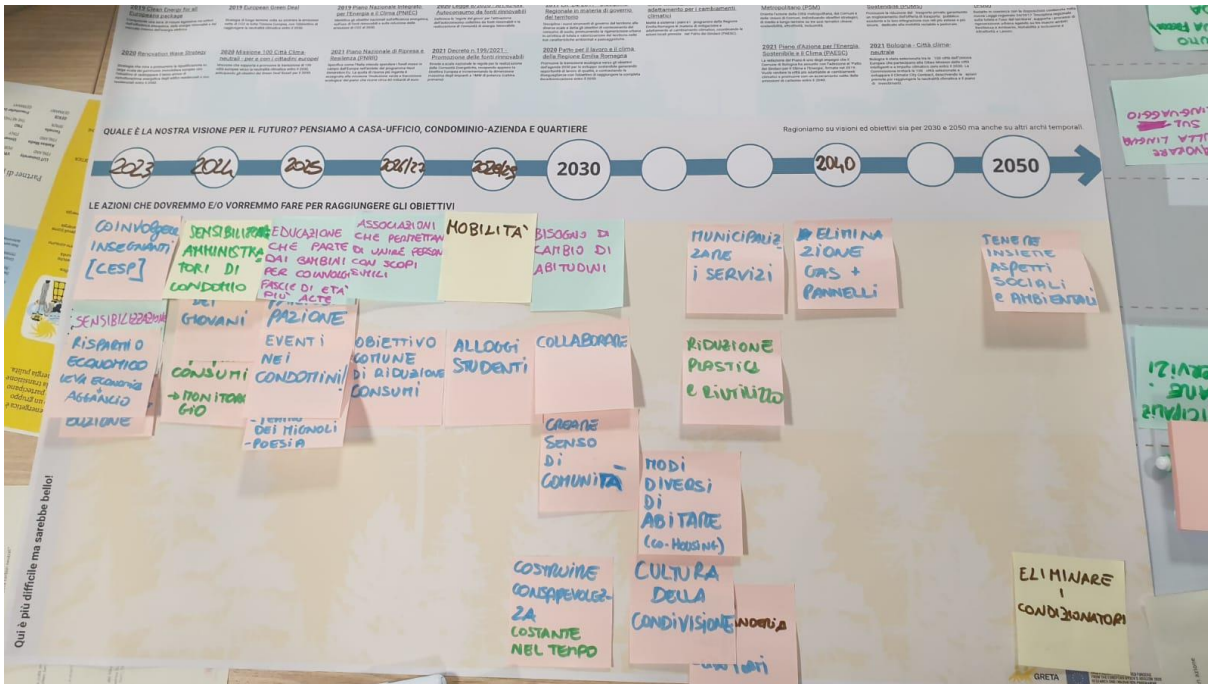


Fig. 02 - A completed canvas after a GRETA community workshop

Just Accepted

Cittadinanza energetica. Strumenti e tecnologie per abilitare la transizione nei distretti

Danila Longo¹, <https://orcid.org/0000-0002-7516-7556>

Saveria Olga Murielle Boulanger¹, <https://orcid.org/0000-0003-2147-3192>

Martina Massari¹, <https://orcid.org/0000-0002-5483-5869>

Giulia Turci¹, <https://orcid.org/0000-0003-0930-0838>

¹ Dipartimento di Architettura, Università di Bologna, Italia

Primary Contact: Danila Longo, danila.longo@unibo.it

Abstract

Le risposte alla crisi energetica attuale e all'azione contro il cambiamento climatico in generale hanno prodotto una grande varietà di sperimentazioni. I PEDs (Positive Energy Districts) e le Comunità Energetiche si stanno diffondendo come "aggregatori" di tecnologie abilitanti, ma le conoscenze e le competenze necessarie per pianificare, implementare e monitorare necessitano di ulteriore sviluppo. La tecnologia da sola, infatti, non è sufficiente per facilitare la condivisione delle conoscenze, la sperimentazione e la co-creazione delle soluzioni. Il contributo mette a fuoco modalità e strumenti che consentono di supportare la creazione di "cittadini energetici", attraverso le riflessioni sviluppate nel progetto H2020 GRETA (Green Energy Transition Actions) e nella COST Action 'PED-EU-NET'.

Parole chiave: cittadinanza energetica; positive energy districts (PEDs), neutralità climatica, transizione energetica; comunità.

Introduzione

La pianificazione strategica europea pone la necessità di accelerare notevolmente sulle politiche energetiche e ambientali e sulla messa in atto di azioni ad ampio raggio che abbiano impatti efficaci, immediati e a lungo termine (European Commission, 2019b). Questo è confermato dagli ultimi report IPCC (*Intergovernmental Panel on Climate Change*) (IPCC, 2022a, 2022b), ma anche dai più recenti avvenimenti socio-politico-economici che stanno mettendo a dura prova l'applicabilità (e la popolarità) delle strategie ambientali a fronte delle gravi emergenze energetiche causate dalle attuali questioni geopolitiche.

Le città necessitano di strategie efficaci e condivise per la transizione verso la neutralità climatica anche accelerando il ricorso alle frontiere tecnologiche. Al contempo, appare evidente come la sola implementazione tecnologica non sia sufficiente: il coinvolgimento della cittadinanza e, soprattutto, di una cittadinanza attiva, informata e concorde risulta necessario (European Commission, 2019a). Tuttavia, il dialogo attorno a processi tecnici, legati ad esempio all'uso e consumo dell'energia, è complesso a causa delle difficoltà tecnico-operative del tema dell'energia, ma anche per la scarsa chiarezza e disponibilità dei dati relativi alla sua produzione, uso e consumo, per ragioni a volte di *privacy*, o legate al mercato o, ancora, per ragioni politiche.

Se il coinvolgimento della cittadinanza rispetto ai temi dei consumi domestici e delle strategie di base relative al risparmio energetico in casa e in ufficio avviene in maniera più diffusa, l'attivazione di dinamiche di gruppo, la comprensione del funzionamento delle reti altamente tecnologiche, come la *smart grids*, il coinvolgimento dei singoli in processi multi-attore di autoconsumo e produzione energetica risulta solo recentemente perseguito. È in questa direzione che si muovono, per esempio, le Comunità Energetiche (CE) ma anche i più innovativi *Positive Energy Districts* (PEDs). In EU, infatti, sono in fase di definizione, sviluppo e sperimentazione questo tipo di soluzioni tecnologicamente avanzate per distretti urbani energeticamente performanti, così come soluzioni

per la creazione di comunità energetiche di mutuo scambio tra cittadini e imprese, strategie per l'inclusione dei singoli in processi ampi che coinvolgono non solo gli utenti finali ma anche produttori, municipalità, grandi e medie aziende.

In questo contesto si posizionano alcune ricerche volte a comprendere come la cittadinanza energetica possa essere sviluppata e sostenuta nel tempo. Il presente articolo intende contribuire a questo filone di ricerca, presentando e proponendo alcuni strumenti, strategie e riflessioni derivati da due progetti finanziati dalla Commissione Europea: Horizon 2020 - GRETA (GReen Energy Transition Actions; GA101022317) e la COST Action 'Positive Energy District European Network'. Il presente contributo è articolato in cinque sezioni. La prima propone una revisione qualitativa della letteratura di riferimento per i temi di cittadinanza energetica e PEDs; la seconda definisce le metodologie della ricerca; la terza e la quarta propongono strumenti operativi rispettivamente in casi PEDs e in un caso reale identificato in un'ampia area urbana della città di Bologna. Infine, la quinta sezione propone alcune riflessioni e possibili sviluppi futuri della ricerca.

La cittadinanza energetica in Europa: un tema ancora da chiarire nel suo rapporto con le tecnologie innovative

Quello della cittadinanza energetica è un concetto recente, che emerge a cavallo degli anni 2004-2010 come tema chiave della transizione energetica europea e mondiale.

Una ricerca su *Google Scholar* evidenzia come fino al 2004-2005 non siano quasi presenti articoli che menzionano il concetto, fatta eccezione per (Devine-Wright, P., 2004), considerato il primo articolo in cui si approccia il tema. Tra il 2006 e il 2010 sono presenti 38 articoli che affrontano la questione, anche se la locuzione "*energy citizenship*" tende a non apparire nei titoli. Dall'analisi affrontata, Devine-Wright (Devine-Wright, 2006; Walker and Devine-Wright, 2008) appare comunque pioniera nella ricerca sulla tematica. Una presenza più importante della locuzione, soprattutto nei titoli, avviene nel quinquennio successivo (2011-2015), periodo in cui sono presenti 135 articoli sul tema. Questa attenzione crescente è confermata nei periodi successivi: tra il 2016 e il 2020 appaiono 377 articoli sul tema e nell'ultimo biennio 2021-2022, 364. Questa breve verifica conferma come la cittadinanza energetica stia vedendo un interesse crescente e come ci sia una urgenza nella identificazione di metodologie e strategie per un maggior coinvolgimento della società civile nella transizione energetica (European Commission, 2019a; Schlindwein and Montalvo, 2022; Schot, J. et al., 2016).

Il concetto di "cittadinanza energetica", infatti, fa riferimento al coinvolgimento attivo di persone non specializzate all'interno di un sistema complesso, come quello energetico. Con coinvolgimento attivo si intende la presenza di azioni volontarie, dirette e concrete che i cittadini operano all'interno del settore energetico. Secondo la letteratura sul tema, l'inclusione dei cittadini nei processi decisionali relativi al sistema energetico influenza la più generale risposta della comunità a innovazioni e interventi nel settore e sostiene una migliore accettazione delle soluzioni di decarbonizzazione (Schlindwein and Montalvo, 2022; Sovacool et al., 2020).

Nonostante la locuzione "cittadinanza energetica" sia solo una delle più recenti (si ricordano, per esempio le locuzioni "cittadinanza performativa" o "cittadinanza sostenibile" o "democrazia energetica"), l'associazione del termine "cittadino" a quello di "energia" mette in luce una precisa connessione tra diritti e doveri dell'individuo e l'energia stessa. Devine-Wright afferma come il pubblico sia concepito come parte attiva nell'evoluzione del sistema energetico e come il suo potenziale di azione sia inquadrato da nozioni di diritto e di responsabilità equi in tutta la società per affrontare le conseguenze del consumo di energia, in particolare il cambiamento climatico (Devine-Wright, P., 2004, p. 71). Questi aspetti di diritto e responsabilità sono elementi chiave della definizione, poiché da un lato definiscono come l'energia debba essere un diritto di tutti; quindi, essere accessibile a tutti coloro che vivono in una condizione di cittadinanza (incluse le persone economicamente più fragili), dall'altro come esista una responsabilità dei singoli nel supportare una miglior gestione, consumo e produzione della stessa a livello urbano e territoriale (Olivadese et al., 2021; Wahlund and Palm, 2022)

Per quanto il tema sia largamente diffuso nel dibattito scientifico, una definizione certa e largamente accettata sembra non essere presente, non solo dal suo punto di vista teorico, ma soprattutto da quello operativo (Beauchampet and Walsh, 2021; Lennon et al., 2020; Schlindwein and Montalvo, 2022; Wahlund and Palm, 2022). Un elemento che sembra quasi interamente mancare è la relazione che intercorre tra la necessità di coinvolgere la cittadinanza in forme più attive e tecnologie e strumenti necessari per farlo. In particolare, due innovazioni chiave possono supportare questa direzione: le Comunità Energetiche e i Positive Energy Districts o distretti ad energia positiva.

Le Comunità Energetiche possono essere generalmente definite come gruppi di utenti (privati, pubblici o entrambi) che si organizzano o auto-organizzano per condividere energia (Boulanger et al., 2021; Rathnayaka et al., 2011). Le recenti evoluzioni normative europee e italiane tendono a favorire questo tipo di raggruppamento, motivo per cui diverse comunità energetiche sono nate a livello europeo e stanno nascendo in Italia.

I *Positive Energy Districts* si configurano come modello innovativo di transizione energetica (Sareen et al., 2022). Introdotti nel panorama europeo dallo *Strategic Energy and Technology Plan (SET-Plan Working Group 3.2, 2018)*, vengono definiti come aree urbane efficienti e flessibili dal punto di vista energetico che producono zero emissioni nette di gas a effetto serra e gestiscono attivamente una produzione annuale di energia rinnovabile locale o regionale (JPI Urban Europe, 2020, p. 4). Il successo delle sperimentazioni PEDs è strettamente legato all'adozione di soluzioni tecnologiche localmente specifiche e innovative ma, anche all'accettazione e alla partecipazione alle stesse da parte dei cittadini (Cheng et al., 2022) e di tutti gli attori fin dalle prime fasi di pianificazione (Ahlers et al., 2019).

Metodologia e Obiettivi

La ricerca è stata svolta utilizzando una metodologia qualitativa basata su due approcci paralleli:

- uno aggiornamento dello stato dell'arte e identificazione di alcuni strumenti e strategie emergenti;
- studio e test di uno strumento (*Community Transition Pathway*) in un contesto reale, la città di Bologna (Italia), dove diverse strategie di transizione verso la creazione di nuove comunità energetiche e la predisposizione di un distretto ad energia quasi zero sono in corso.

A partire da questa analisi, obiettivo del contributo è sistematizzare alcune possibili linee strategiche per supportare l'evoluzione tecnologica e sostenibile nei quartieri, attraverso strumenti che aiutino le comunità stesse ad essere autonome, informate e attive.

Strumenti abilitanti: i Positive Energy Districts

I PEDs, così come le comunità energetiche, sono infrastrutture complesse di tipo socio-tecnico in grado di coniugare la componente tecnologica agli aspetti ambientali, sociali ed economici. A partire dall'analisi della letteratura e dei principali progetti di ricerca attualmente in corso in Europa, sono stati schedati i più interessanti strumenti volti a facilitare il processo di realizzazione, replica e scalabilità dei PEDs (Tabella 01).

La schedatura ha permesso di individuare tre principali categorie di strumenti:

- Strumenti per facilitare la conoscenza: raccolte di casi studio, progetti, buone pratiche e lezioni apprese che mettono a sistema esperienze e soluzioni innovative facilitando la conoscenza del modello PED. In particolare, il *Booklet of PEDs*, sviluppato da JPI Urban Europe, si struttura come una raccolta di casi studio di riferimento al fine di identificare le caratteristiche comuni, le strategie, le sfide e gli elementi di successo per guidare gli stakeholders nell'implementazione (Bossi et al., 2020). Il *PED Database*, in corso di realizzazione nell'ambito della COST Action '*PED-EU-NET*' in collaborazione con le iniziative Annex 83 (<https://annex83.iea-ebc.org/>) e JPI UE (<https://jpi-urbaneurope.eu/ped/>), può essere considerato un'evoluzione in formato digitale del Booklet. Il Database si strutturerà come una vera e propria piattaforma *open access* interoperabile, in cui sarà possibile esplorare e comparare casi studio, progetti, iniziative, strategie, policies e soluzioni rilevanti per lo sviluppo di questi distretti (Turci et al., 2022). La *PED Learning Community*, realizzata dal progetto H2020-Atelier, è una piattaforma online che facilita la conoscenza del concetto di PED attraverso la sistematizzazione di materiali informativi,

- video-lezioni e workshops e la promozione di attività di networking che coinvolgono cittadini ed esperti (“Atelier project, PED Learning Community Platform,” 2022).
- Strumenti per supportare il coinvolgimento degli stakeholders: mirano a facilitare la partecipazione di questi ultimi nelle diverse fasi di implementazione di interventi alla scala di distretto. Il progetto +CityxChange, nelle città pilota di Limerick e Groningen, lavora allo sviluppo di un modello condiviso per la realizzazione di laboratori urbani partecipativi –*Innovation Playgrounds* - in cui ricercatori, professionisti, municipalità, associazioni e cittadini collaborano alla sperimentazione di soluzioni innovative in chiave PEDs (Mee et al., 2021). Nell’ambito dell’iniziativa internazionale Annex 83 ‘Positive Energy Districts’, lo studio condotto da (Cheng et al., 2022) propone di ampliare la *PED Toolbox* sviluppando uno strumento per mappare gli stakeholders coinvolti nelle diverse fasi del processo di realizzazione di un PED.
 - Strumenti per agevolare il processo decisionale e concretizzazione: si tratta principalmente di metodologie *step-by-step* che accompagnano l’implementazione dei PEDs con una particolare attenzione alla fase di pianificazione dell’intervento. La ricerca svolta (Civiero et al., 2022, 2021) propone un modello di simulazione innovativo, denominato PEDRERA, per supportare azioni di riqualificazione in chiave PED da applicare in contesti urbani consolidati. Nell’ambito del progetto di ricerca *Making-City* viene sviluppata una metodologia per accompagnare le città nell’implementazione dei PEDs: a partire dallo studio delle componenti urbane e dall’analisi degli strumenti di pianificazione e della domanda energetica, si identifica l’area più adatta e si pianificano le strategie e le azioni da adottare in funzione delle condizioni sociali, economiche e ambientali del contesto in cui si interviene (Alpagut et al., 2019).

Il *Community Transition Pathway* e la sua applicazione nel contesto del rione Pilastro e dell’area Le Roveri a Bologna

Il rione Pilastro e la zona industriale Le Roveri sono due aree limitrofe della zona periurbana a nord-est della città di Bologna. Considerati insieme hanno un’estensione totale di circa 400 ettari con funzioni miste. La zona nord è prevalentemente caratterizzata dal comparto residenziale di Pilastro, mentre l’area sud si costituisce come area a prevalente vocazione industriale e ospita grandi, piccole e medie imprese legate a diversi settori. Il rione Pilastro risulta particolarmente interessante dal punto di vista della comunità e della sua storia. Si tratta di un’importante esperienza di costruzione *ex-novo* di un quartiere di *housing* sociale risalente agli anni ’60. Oggi l’area appare rilevante per la ricerca per diversi motivi, tra cui la presenza di una comunità variegata (anche dal punto di vista culturale e salariale) che possiede un forte senso di appartenenza con la presenza di un importante associazionismo, la presenza di imprese che necessitano strategie di riduzione dei consumi energetici; la presenza di uno dei parchi fotovoltaici più grandi d’Europa, sui tetti di CAAB, caratterizzato da una produzione di 11.350.000 Kw/h di energia primaria. Sull’area sono attive alcune ricerche condotte dall’Università di Bologna, Dipartimento di Architettura, in partnership con altri soggetti dell’area e attori del territorio. Tra queste si cita, in particolare, il progetto GECCO - Green Energy Community, finanziato da EIT Climate-KIC (attivo da luglio 2019), che ha l’obiettivo di realizzare una comunità energetica e GRETA - GReen Energy Transition Actions, finanziato dal programma H2020, che si propone di abilitare un ampio e attivo coinvolgimento dei cittadini nei processi di transizione energetica, formulando dei Percorsi di Transizione (*Community Transition Pathways*) volti a guidare le comunità verso differenti livelli di consapevolezza riguardo le tematiche energetiche e gli obiettivi di decarbonizzazione.

I *Community Transition Pathways* sono uno strumento innovativo costruito dal gruppo di ricerca dell’Università di Bologna, in collaborazione con i partner di progetto, e si configurano come una piattaforma di accompagnamento alla comunità nell’identificare e chiarire i propri obiettivi legati alla transizione energetica e alla costituzione di strategie innovative come le comunità energetiche o i gruppi di autoconsumo. Questo strumento è strutturato in diversi componenti, tra cui una guida (*canvas*) alla costruzione di scenari e obiettivi di transizione e alcuni suggerimenti di condivisione e collaborazione con gli attori locali e la municipalità. Lo strumento è stato testato nel corso di alcuni incontri di co-progettazione. L’utilizzo del *canvas*, in particolare, ha permesso alla comunità di:

- ridiscutere internamente e insieme ai ricercatori, gli obiettivi di miglioramento energetico della comunità di residenti, nel breve, medio e lungo termine;
- inquadrare questi obiettivi all'interno della pianificazione strategica urbana più ampia;
- costruire una gerarchia di azioni, a seconda del livello di fattibilità e rapidità o della necessità di negoziazione con altri attori del territorio. L'immagine (Fig.02) mostra uno dei canvas utilizzati e compilati in uno degli appuntamenti con la comunità.

Discussione e Conclusioni

La maggiore accessibilità di comunità di cittadini a tematiche riguardanti l'energia, offerte da aggregatori di tecnologie abilitanti come i PEDs e le comunità energetiche, rappresenta un'opportunità di crescita e transizione dei territori. Le ricerche condotte confermano il ruolo delle tecnologie come elementi trainanti la transizione energetica, ma solo se accompagnati da opportune attività e strumenti di supporto alle comunità locali. Dai progetti presentati emerge, seppur in maniera diversa, come esistano già diversi modelli e strumenti di coinvolgimento, che tuttavia hanno la necessità di essere correttamente utilizzati con le comunità. Dal progetto GRETA, in particolare, e dai numerosi incontri con la comunità, emerge chiaramente come il tema energetico sia complesso, sia dal punto di vista tecnico, sia economico e gestionale. Tuttavia, il CTP (*Community Transition Pathway*) presentato, unito all'attività di *tutoring* effettuata dai ricercatori, mette in evidenza come un grado maggiore di comprensione da parte della cittadinanza sia raggiungibile, a fronte di una disponibilità di scambio reciproco di conoscenze e di un ragionamento prospettico collettivo. In questa direzione, la partecipazione alle attività dei due progetti presentati consente di evidenziare alcuni spunti di riflessione, utili a tratteggiare un percorso di ricerca sull'accessibilità delle tecnologie (e degli aggregatori che le contengono) per accompagnare la transizione energetica delle comunità. Un primo punto riguarda la conoscenza e l'integrazione di più soluzioni. Comunità energetiche e PEDs possono essere alleati della transizione, mettendo in rilievo l'uno gli aspetti collaborativi a livello comunitario e l'altro le più importanti innovazioni tecnologiche. Nessuno dei due può esimersi da una conoscenza situata del contesto territoriale specifico e della sua popolazione.

Un altro punto riguarda il coinvolgimento, la consapevolezza e la responsabilizzazione dei cittadini nelle trasformazioni che li riguardano direttamente e indirettamente. Se da un lato è necessario infondere un senso di responsabilità e di urgenza, dall'altro è importante comprendere le reali barriere che i cittadini hanno nell'attuare strategie di mitigazione e transizione energetica, economica, culturale, conoscitiva. Queste devono trovare concrete risposte da parte di un gruppo multidisciplinare di supporto alla trasformazione (agenzie di accompagnamento energetico, staff tecnico delle amministrazioni, alleanze con le università).

Ultimo punto riguarda l'urgenza di un'implementazione efficace di interventi, anche in forma di azioni-pilota. Sperimentazioni in scala micro, veloci e reversibili, consentono di valutare e osservare l'efficacia di interventi, senza richiedere investimenti ingenti o tecnologie complesse. Queste, tuttavia, necessitano dell'utilizzo di strumenti gestionali e di un *framework* condiviso tra tutti gli attori. Pur lontano dal considerarsi esaustivo, il contributo mette in luce alcuni elementi emersi dalle ricerche condotte, mettendo in relazione di aggregatori di tecnologie abilitanti, come le comunità energetiche e i PEDs. La ricerca sottolinea come questi due approcci debbano lavorare in maniera sinergica, per poter essere considerati come alleati nel percorso di transizione.

Le future applicazioni di questi punti di attenzione nei progetti di ricerca in corso sull'area bolognese potranno fornire ulteriori sviluppi e risultati di discussione più approfonditi e basati su un maggior numero di dati.

References

- Ahlers, D., Driscoll, P., Wibe, H., Wyckmans, A., 2019. Co-Creation of Positive Energy Blocks. IOP Conf. Ser.: Earth Environ. Sci. 352, 012060. <https://doi.org/10.1088/1755-1315/352/1/012060>
- Alpagut, B., Akyürek, Ö., Mitre, E.M., 2019. Positive Energy Districts Methodology and Its

- Replication Potential. Proceedings 20, 8. <https://doi.org/10.3390/proceedings2019020008>
- Atelier project, PED Learning Community Platform [WWW Document], 2022. URL <https://www.pedlearning.eu/home> (accessed 9.2.22).
- Beauchampet, I., Walsh, B., 2021. Energy citizenship in the Netherlands: The complexities of public engagement in a large-scale energy transition. *Energy Research & Social Science* 76, 102056. <https://doi.org/10.1016/j.erss.2021.102056>
- Bossi, S., Gollner, C., Theierling, S., 2020. Towards 100 Positive Energy Districts in Europe: Preliminary Data Analysis of 61 European Cases. *Energies* 13, 6083. <https://doi.org/10.3390/en13226083>
- Boulanger, S.O.M., Massari, M., Longo, D., Turillazzi, B., Nucci, C.A., 2021. Designing Collaborative Energy Communities: A European Overview. *Energies* 14, 8226. <https://doi.org/10.3390/en14248226>
- Cheng, C., Albert-Seifried, V., Aelenei, L., Vandevyvere, H., Seco, O., Nuria Sánchez, M., Hukkalaianen, M., 2022. A Systematic Approach Towards Mapping Stakeholders in Different Phases of PED Development—Extending the PED Toolbox, in: Littlewood, J.R., Howlett, R.J., Jain, L.C. (Eds.), *Sustainability in Energy and Buildings 2021, Smart Innovation, Systems and Technologies*. Springer, Singapore, pp. 447–463. https://doi.org/10.1007/978-981-16-6269-0_38
- Civiero, P., Pascual, J., Arcas Abella, J., Bilbao Figuero, A., Salom, J., 2021. PEDRERA. Positive Energy District Renovation Model for Large Scale Actions. *Energies* 14, 2833. <https://doi.org/10.3390/en14102833>
- Civiero, P., Pascual, J., Arcas Abella, J., Salom, J., 2022. Innovative PEDRERA Model Tool Boosting Sustainable and Feasible Renovation Programs at District Scale in Spain. *Sustainability* 14, 9672. <https://doi.org/10.3390/su14159672>
- Devine-Wright, P., 2006. Energy Citizenship: Psychological Aspects of Evolution in Sustainable Energy Technologies, in: *Governing Technology for Sustainability*. Routledge.
- Devine-Wright, P., 2004. Towards zero-carbon: Citizenship, responsibility and the public acceptability of sustainable energy technologies. Presented at the Proceedings of Conference C81 of the Solar Energy Society, UK section of the International Solar Energy Society, pp. 51–62.
- European Commission, 2019a. Orientations towards the first Strategic Plan for Horizon Europe. Directorate Research and Innovation.
- European Commission, 2019b. A European Green Deal [WWW Document]. European Commission - European Commission. URL https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en (accessed 7.20.22).
- IPCC, 2022a. *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press. ed. Cambridge.
- IPCC, 2022b. *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, UK and New York, NY, USA.
- JPI Urban Europe, 2020. *White Paper on PED Reference Framework for Positive Energy Districts and Neighbourhoods*.
- Lennon, B., Dunphy, N., Gaffney, C., Revez, A., Mullally, G., O'Connor, P., 2020. Citizen or consumer? Reconsidering energy citizenship. *Journal of Environmental Policy & Planning* 22, 184–197. <https://doi.org/10.1080/1523908X.2019.1680277>
- Mee, A., Lyes, M., Crowe, P., 2021. Energy Urbanity and Active Citizen Participation. *Energies* 14, 6515. <https://doi.org/10.3390/en14206515>
- Olivadese, R., Alpagut, B., Revilla, B.P., Brouwer, J., Georgiadou, V., Woestenburg, A., van Wees, M., 2021. Towards Energy Citizenship for a Just and Inclusive Transition: Lessons Learned on Collaborative Approach of Positive Energy Districts from the EU Horizon2020 Smart Cities and Communities Projects. *Proceedings* 65, 20.

- <https://doi.org/10.3390/proceedings2020065020>
- Rathnayaka, A.J.D., Potdar, V.M., Hussain, O., Dillon, T., 2011. Identifying prosumer's energy sharing behaviours for forming optimal prosumer-communities, in: 2011 International Conference on Cloud and Service Computing. Presented at the 2011 International Conference on Cloud and Service Computing, pp. 199–206. <https://doi.org/10.1109/CSC.2011.6138520>
 - Sareen, S., Albert-Seifried, V., Aelenei, L., Reda, F., Etminan, G., Andreucci, M.-B., Kuzmic, M., Maas, N., Seco, O., Civiero, P., Gohari, S., Hukkalainen, M., Neumann, H.-M., 2022. Ten questions concerning positive energy districts. *Building and Environment* 216, 109017. <https://doi.org/10.1016/j.buildenv.2022.109017>
 - Schlindwein, L., Montalvo, C., 2022. Accounting for heterogenous behaviours within transformative policy-making: the case of Energy Citizenship.
 - Schot, J., Kanger, L., Verbong, G., 2016. The roles of users in shaping transitions to new energy systems | *Nature Energy*. *Nature energy* 1, 1–7.
 - SET-Plan Working Group 3.2, 2018. Europe to become a global role model in integrated, innovative solutions for the planning, deployment, and replication of Positive Energy Districts, SET-Plan Action No 3.2.
 - Sovacool, B.K., Turnheim, B., Martiskainen, M., Brown, D., Kivimaa, P., 2020. Guides or gatekeepers? Incumbent-oriented transition intermediaries in a low-carbon era. *Energy Research & Social Science* 66, 101490. <https://doi.org/10.1016/j.erss.2020.101490>
 - Turci, G., Alpagut, B., Civiero, P., Kuzmic, M., Pagliula, S., Massa, G., Albert-Seifried, V., Seco, O., Soutullo, S., 2022. A Comprehensive PED-Database for Mapping and Comparing Positive Energy Districts Experiences at European Level. *Sustainability* 14, 427. <https://doi.org/10.3390/su14010427>
 - Wahlund, M., Palm, J., 2022. The role of energy democracy and energy citizenship for participatory energy transitions: A comprehensive review. *Energy Research & Social Science* 87, 102482. <https://doi.org/10.1016/j.erss.2021.102482>
 - Walker, G., Devine-Wright, P., 2008. Community renewable energy: What should it mean? *Energy Policy* 36, 497–500. <https://doi.org/10.1016/j.enpol.2007.10.019>

Didascalie immagini

Tab. 01 - Strumenti abilitanti i PEDs

Fig. 01 - Un evento di co-progettazione del progetto GRETA

Fig. 02 - Un cartellone compilato dalla comunità durante un evento di co-progettazione del progetto GRETA