

The role of local public bodies promoting health and well-being by boosting energy transition in social housing.

The case of a renewable energy community in Portugal

Luísa BATISTA, CITTA Research Centre for Territory Transports and Environment, Rua Roberto Frias s/n, 4200-465 Porto; Portugal

Abstract

Energy transition is an ongoing process, with positive externalities to the health and well-being of communities. Local public bodies, such as municipalities, have a relevant role in this process, namely in investing and promoting transition in social housing. By this way, there are real possibilities to reduce the energy poverty that affects many of the inhabitants of these communities, with gains for their health and well-being. In this context, it is important to understand the role and potential of each stakeholder to boost future stages and processes, converging with climate agenda and Sustainable Development Goals as fast as possible, and assuring principles of energy justice, inclusive planning and communities' empowerment. This presentation focuses on deepen understanding the contribution of local public bodies to accelerate local energy transition, considering their potential as forerunners of change, namely assuming a decisive role leading collaborative governance platforms, considering different interests, expectations and goals, in order to co-create social value beyond the shifting to renewables. A specific case study is presented - a Renewable Energy Community (REC) in a social housing neighbourhood of the city of Porto - and the model of its governance structure, led by a local public body.

Keywords

Energy transition, Energy poverty, Local Public Bodies, Renewable Energy Communities

1. Introduction

Energy is a central and inescapable pillar of our communities' life, what is proved by the impacts of the events occurred in Europe, in the current year. Furthermore, massive scientific evidence shows that a complete and consistent response to climate change challenges depends on energy issues. The necessary and urgent transition of the energy paradigm is now, as never before, on the side of society's adherence to those new models of energy production and consumption. Over the last decades, technological innovation has already produced promising and consistent results to enable shifting from fossil fuels to renewable energy sources. However, a technological fix has not been enough (Schaffer and Brun, 2015). This on-going process lacks a strong investment on governance and social dimension and dynamics of low-carbon transition to foster its diffusion, social acceptance and local support to already available technologies, otherwise it is not possible to ensure the achievement of significant results and contributions to the decarbonization process, without compromising the supply security of households. Still, the time and urgency to achieve results from change forces us to think and consider ways to accelerate the social response (UN, 2015).

In this context of energy paradigm transition, the role that Renewable Energy Communities (RECs) - groups of citizens, social entrepreneurs, public authorities and community organisations participating directly in the energy transition by jointly investing in, producing, selling and distributing renewable energy (Lowitzsch et al., 2020) - can assume a decisive relevance in this process, aiming to boost their potential for spreading new practices of energy prosumer and microgrid consumption. If we look beyond the immediate conceptual issues associated with RECs (related, *strictus sensus*, to the energy sources) we can find positive collateral impacts on it, particularly when a public agent takes a leading role in the process. This can be the role of local public bodies and specifically the case of municipalities when acting as owner of social housing, having the initiative and the responsibility of implementing an energy transition process based on a collaborative and participative governance model. The intervention of local public bodies in social housing by founding a REC can also contribute to act over the social problem 'energy poverty', promoting household energy resilience, and, finally, inducing other sustainable practices (for example, mobility practices).

This paper begins by presenting a short overview of the analytical framework of the proposal approach, namely referring the interest of the social studies of energy and their importance in the way they highlight the role of social aspects in the necessary change of the energy paradigm and, secondly, referring the new architecture of energy system that promotes decentralisation of energy production and democratisation. After this initial framework, we establish a link between the changes in the energy system (both through the adoption of clean technologies and the implementation of new models of decentralized governance) and the opportunity that this change provides to act on the problem of energy poverty in disadvantaged communities housing social housing. The third part of the paper presents a case study of a REC in Porto (Portugal), which has the particularity of being led by a local public body, which additionally allows exploring the potential of this governance model in the framework of cities' energy transition.

Given the project's implementation phase, which is still in its early stages, this paper was mainly based on information collected through direct contact with one of the promoters (AdE), as well as on the processing of information from reports and public presentations related to this pilot project.

2. Analytical framework: energy and the potential of Renewable Energy Communities

Energy is one of the hot topics of the moment and literature reflects it through the growing research and debate on the field, with a particular focus on the so-called social studies of energy. At the same time, energy systems have been recently subject to a great deal of attention, namely at the legal and institutional levels, which has led to its radical transformation, enabling the emergence of an energy system with a different design, integrating decentralized production and new consumption models, and absorbing more diverse actors and ownerships of energy production and new partnerships (Lowitzsch et al., 2020). This new architecture is based on principles such as energy democracy, energy citizenship, energy literacy, prosumerism and just energy transition. It enhances capacity building and community empowerment.

Within this emergent context, where Renewable Energy Communities are new stakeholders and key-players in a redesigned energy system, Portugal is now taking its first steps, namely by leveraging the very relevant potential of renewable energy sources in the country, such as solar ones. Furthermore, the possibility to explore a virtuous connection with the existing building stock, matching or bringing production and consumption together, can open the way to an energy system that is less burdensome in terms of the impacts it causes on land use and ecosystems.

Renewable Energy Communities (RECs) – based on the generation of energy from renewable resources and clean technologies, which are partly or wholly owned by groups of citizens, social entrepreneurs, public authorities and community organizations (Heldeweg and Saintier, 2020; UN, 2021) - have emerged, in Portugal, from the redesign of the legal framework of the energy system – namely the decree DL 15/2022 (14.01) that establishes the organization and operation of the National Electric System, transposing the Directive (UE) 2019/944 and the Directive (UE) 2018/2001, the decree DL 162/2019 that approves the legal regime applicable to self-consumption of renewable energy and, finally, the law n.º 98/2021 (31.12.2021) named ‘Climate Framework Law’ - in response to an urgent need to decarbonize economies and urban systems, within the framework of international climate policies and strategies (UN, 2015; EC, 2016; EC, 2019). Recent events in Europe and around the world have only sharpened the recognition that promoting energy independence by boosting the use of renewable energy sources gives resilience to families, communities, but also to countries. In that sense, RECs gain more arguments in their favour, evidencing their relevant contribution to this challenge of achieving energy autonomy.

Despite the typological diversity they may assume (Lowitzsch et al., 2020; Gui and MacGilla, 2018; Algarvio, 2021; Koirala et al., 2016; Moroni et al., 2019), at the basis of the RECs design, of their internal organization and of their relationship with the emergent decentralized energy system, as a whole, they are principles of energy democracy, energy literacy and energy justice (and a certain mission to promote them) (Szulecki, 2018; Wittmayer et al., 2022; Breffini et al., 2020; Bouzarovski and Simcock, 2017). In addition, RECs, as community-driven initiatives, are processes of both energy transition and social innovation, able to enhance sustainable energy production and also sustainable consumption practices, assuming a key role in the energy consumer behaviour, changing the previous mainstream passive consumer into an emergent energy prosumer (Adams et al., 2021; Andrews-Speed, 2016; Caramizaru and Uihlein, 2020; Defil et al. 2018; Hessa and Sovacool, 2020; Hoppe and Vries, 2018). But RECs also have a very relevant potential in the face of the energy poverty problem, making very effective contributions to solving it, making the most vulnerable and deprived social groups more resilient (Bouzarovski and Petrova, 2015; Bouzarovski and Tirado-Herrero, 2017; Horta et al., 2019; Kyprianou et al., 2019; Hasseqvist et al., 2022).

All these dimensions and potentials of RECs refer to the recognition of their social value in the energy transition process, both from the point of view of the role they can play in speeding up the process, and in their role in transposing sustainable attitudes to other areas of community functioning (for example, sustainable mobility attitudes) (Lennon et al, 2019; Schoor et al., 2016; Komendantova, 2021; Doci et al., 2015).

Notwithstanding that there are other types of RECs (more market related), also with relevant impacts on the redesign of the energy system and on the energy transition process, we focus on a particular type that involve and is leading by local public bodies (municipalities, local enterprises of the municipal authority ecosystem, foundations) with an explicit and well-defined goal of intervening in social housing (broadening the scope of the intervention plan to public facilities located in its surroundings).

3. The Renewable Energy Community of Agra do Amial (Porto, Portugal)

3.1. Concept and regulatory framework of Renewable Energy Communities

Accompanying the intense redefinition of the energy sector, in response to urgent needs to support the agenda of policies to combat climate change, the last few years have been marked by profound changes in its legal framework. The definition and regulation of RECs fits into this context. Currently, the Renewable Energy Communities are linked with Renewable Energy Directive 2018/2001/EU on the promotion of the use of energy from renewable sources (RED II), in the frame of Clean Energy for all Europeans package in order to achieve the ambitious European Green Deal objectives and, in a global scale, to accomplish the Sustainable Development Goals of 2030 Agenda 2030 (United Nations).

The Renewable Energy Directive in concrete, which is transposed for national legislation of the Member-states, defines 'renewable energy community' as a legal entity: (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; (b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities; (c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.

In addition to this basic legal document, RECs emerged, in Portugal, interlinked with a *corpus* of legal documents that establish the regulatory framework for the redefinition of the energy system (with emphasis on the decree 15/2022 that establishes the organization and operation of the National Electric

System in accordance with European legislation), based on the transition of the energy paradigm, shifting energy sources from fossil to renewable, as well as promoting the decentralization of production models, and enhancing prosumerism (defined as the increased involvement of customers in the production process) (Lennon et al., 2020; Wittmayer et al., 2022).

Finally, we should not underestimate the important role played in the energy transition processes by the public budgets for financing, available for this purpose, at different levels and for different targets, both at the European Union level and national level (for example the Environmental Fund, namely through the support of the Recovery and Resilience Facility for Energy Efficiency in Buildings - Support for the implementation of Renewable Energy Communities and Collective Self-Consumption). These funding mechanisms, duly articulated with the corresponding public policies, are essential drivers of change (Zawadzki et al. 2022).

3.2. Energy poverty

The topic of energy poverty gained visibility and institutional recognition, fundamentally, after the Directive 2009/72/EC (Internal Market in Electricity), the Directive 2009/73/EC (Internal Market in Natural Gas) and the Directive 2018/2002/EU (Energy Efficiency Directive), in which the need to economically support vulnerable consumers was stated and consider that energy efficiency measures should be taken into account in any strategy to combat energy poverty and consumer vulnerability. The objective of this approach is to ensure basic living standards, taking into account the relevant national context of each country (Bouzarovski and Simcock, 2017). The creation of the European Energy Poverty Observatory (EPOV) is, at this level, a very relevant tool to support the definition of strategies and policies by each member state.

In accordance with Eurostat, in 2020, Portugal is listed as the fifth country in the European Union where people can least afford to keep their homes properly heated, with about 19% of Portuguese people in energy poverty. If we look at the socio-demographic profile of the social housing inhabitants, from which relevant economic vulnerabilities stand out, we find a slice of the population that converges with the definition of energy poverty. In addition to this aspect, studies on poverty, in Portugal, point to the relevance of the housing stock having very low energy efficiency levels, without families having the financial resources to carry out conservation or renovation works that would allow them to increase thermal comfort at home, as well as lower energy costs to have the house adequately heated or cooled (Horta and Schmidt, 2021). The exposure to cold at home not only reduces levels of well-being but also can have serious impacts on the health of the population, even translating into an increase in mortality, and there is a relationship between excess mortality in winter, low thermal efficiency of the home and low temperatures indoors, through the aggravation of cardiovascular and respiratory diseases, arthritis and rheumatism, in addition to the aggravation of some mental problems.

The figure below shows the dimension of the energy poverty problem in Portugal, compared to the European context.

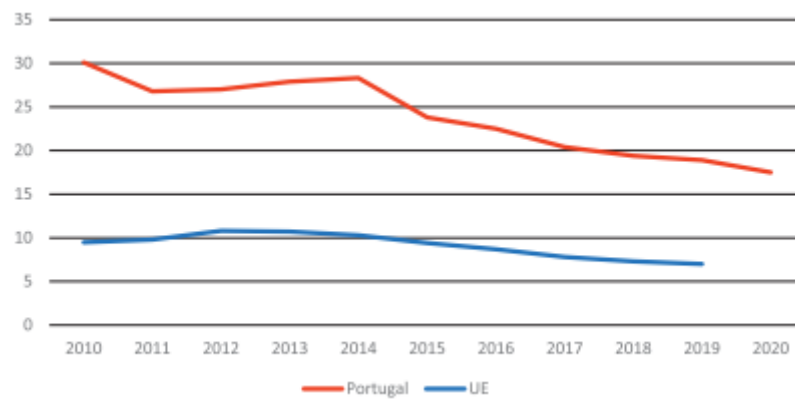


Figure 1. % of families unable to keep the home adequately heated. Source: Eurostat.

Considering this national problem, the present framework of strategies and policies that underpin the energy paradigm transition process provide an opportunity to reduce levels of energy poverty, particularly among the most disadvantaged groups and communities. On the other hand, the intervention focused on solving problems associated with the energy efficiency of buildings and the investment in renewable energy is done in parallel with the promotion of the resilience of communities and families, as well as the promotion of equity, social cohesion and a just energy transition. The creation of CERs is in line with these strategies, since they are investing in the energy efficiency of buildings, in the creation of energy communities, in microgeneration based on renewable energy (especially solar energy), improving by that way the thermal comfort, air quality and public health (Horta and Schmidt, 2021).

3.3. A pilot project to boost city change: REC of Agra do Amial

The REC of Agra do Amial (Porto) - built in 1960, with 181 dwellings (156 in municipal ownership and management) and 362 inhabitants - is the first REC classified as a pilot project by the Portuguese energy sector regulator (ERSE). As a pilot project, its main objective is to test and validate an energy production and consumption model, with its own governance architecture (with public agents leading) and in a specific typology of ownership of residential buildings (public social housing), for later replication in other RECs.

This REC is also integrated in a more comprehensive plan (in terms of territory and objectives) - called Asprela + Sustainable - which aims to become a living lab with the objective of combining sustainable mobility, energy efficiency, renewable energies, circular economy and citizen involvement actions, based on innovation and business models and, on the other hand, contribute to the construction of an urban ecosystem (scalable and replicable), of promotion of the decarbonisation process. Asprela + Sustainable is based on international (EEAGrants) and national public funding and on a governance model centred on partnerships between several entities linked to the municipality of Porto, academia and technology companies.

The fact that the governance model of this REC is based, mostly, on public partnerships, with great centrality of institutions of the universe of the municipality of Porto (owner and manager of the social housing quarters) allowed a more ambitious and comprehensive strategy, from which we can highlight the following objectives, traduced in benefits/outputs (source: AdE Porto).

Table 1. Outcomes foreseen for REc of Agra do Amial. Source: AdE Porto.

OUT-COMES			
Social	Environmental	Economic	Infrastructure
• Promote energy transition • Citizen involvement in the discussion of energy and environmental problems • Behavioural change • Fostering Community Values • Fighting Poverty energy	• Reduction of the carbon footprint • Dissemination of renewable energy sources • Reducing energy dependence from fossil energies • Contribution to achieve strategic objectives (2030, 2050)	• Reduction of energy costs for the consumers • Innovation and development of new solutions and business models	• Reduction of losses in the distribution network with local production and consumption • Development and service delivery of system

In the governance model of this REC, the role of the Porto Energy Agency (AdE Porto) stands out. Its mission is to contribute to the environmental sustainability of the municipalities of the Metropolitan Area of Porto that comprise it, through the promotion of the intelligent use of energy. This institution has also a relevant role, assumed on its public narrative, of searching for solutions to the problem of energy poverty.

In terms of its direct strategic reference framework, Agra do Amial REC emerged under the following policies and strategies of national scope: the National Plan of Energy and Climate 2030 (PNEC 2030 - Plano Nacional Energia Clima), the Carbon Neutrality Roadmap 2050 (RNC 2050 - Roteiro para a Neutralidade Carbónica 2050) and the National Long-Term Strategy to Reduce Energy Poverty 2021-2050 (Estratégia Nacional de Longo Prazo para o Combate à Pobreza Energética 2021-2050). This frame of reference, together with the broader framework previously mentioned (3.1), is quite revealing about the motivation and strategy underlying the intervention, which places in direct relation the process of decarbonization and decentralization of energy production (investing in photovoltaic solar energy) and the intention to contribute to the reduction of poverty energy of families living in social housing (by the reduction of energy costs).

According to data from AdE, besides the reduction in consumption (about 26%) and the reduction of the energy bill (about 10%), this REC also foresees the injection of the production surplus into the grid (about 9,5%), the storage of surplus power generation in second life batteries and the availability of electric vehicle charging equipment in the streets inside and adjacent to the neighborhood, for REC members and other users. As can be seen in the picture below, the surplus production is supplied to a school (Figure 2 - smaller blue circle on the right-hand image) that is in the area adjacent to the neighborhood. All these aspects associated with the core objective of the REC denote a potential to produce effects that go far beyond the energy transition of buildings and even the reduction of energy poverty. There is a very clear potential to promote sustainable behaviours, as well as to create a sense of wider community.



Figure 2. Agra do Amial Neighborhood. Source: AdE Porto.

4. Conclusion

The objective of this paper is to propose a look about Renewable Energy Communities in the general context of the energy transition process and, particularly, in the context of the intervention in public social housing. On the one hand, it emphasizes its commitment to the adoption of new energy production models by disadvantaged communities that would otherwise hardly do so, at this stage of the process. On the other hand, the underlying governance model (with the leadership of public agents in articulation with communities) - exemplified with the case study presented -, has the potential to produce positive effects in terms of reducing energy poverty and, therefore, by this way, to improve the well-being and health of those disadvantaged communities. In addition, RECs have the capacity to, collaterally, promote a sense of community, empower citizens facing energy system and fortify values associated with environmental sustainability and sustainability practices.

Considering that the case study that served as a reference for this article is still very early and there are, for now, no consolidated results of it, there will be interest in monitoring its evolution in order to evaluate, namely, the performance of the governance model. Finally, it will also be interesting to compare the results with other REC models (namely those that do not involve public agents and are closer to exclusively private and free market solutions).

References

- Adams, S.; Brown, D.; Cárdenas Álvarez, J.P.; Chitchyan, R.; Fell, M.J.; Hahnel, U.J.J.; Hojckova, K.; Johnson, C.; Klein, L.; Montakhabi, M.; et al. (2021) 'Social and Economic Value in Emerging Decentralized Energy Business Models: A Critical Review', *Energies* 14, 7864.
- Algarvio, H. (2021) 'The Role of Local Citizen Energy Communities in the Road to Carbon-Neutral Power Systems: Outcomes from a Case Study in Portugal', *Smart Cities*, 4, 840–863.
- Andrews-Speed, P. (2016) 'Applying institutional theory to the low-carbon energy transition', *Energy Research & Social Science* 13, 216–225.

Bouzarovski, S. and Petrova, S. (2015) 'A global perspective on domestic energy deprivation: Overcoming the energy poverty–fuel poverty binary', *Energy Research & Social Science*, 10, 31–40.

Bouzarovski, S. & Simcock, N. (2017) 'Spatializing energy justice', *Energy Policy*, 107, 640–648.

Bouzarovski, S. & Tirado Herrero, S. (2017) 'The energy divide: Integrating energy transitions, regional inequalities and poverty trends in the European Union', *European Urban and Regional Studies*, 24(1), 69–86.

Caramizaru, A. and Uihlein, A. (2020) *Energy communities: an overview of energy and social innovation*, EUR 30083 EN, Publications Office of the European Union, Luxembourg.

Defil, R., Giulio, A., Schweizer, C.R. (2018) 'Two souls are dwelling in my breast: Uncovering how individuals in their dual role as consumer-citizen perceive future energy policies', *Energy Research & Social Science*, 35, 152–162.

Derkenbaeva, E., Vega, S., Hofstede, G., Leeuwen, E. (2022) 'Positive energy districts: Mainstreaming energy transition in urban areas', *Renewable and Sustainable Energy Reviews*, 153.

Doci, G., Vasileiadou, E., Petersen, A. (2015) 'Exploring the transition potential of renewable energy communities', *Futures*, 66, 85–95.

Hessa, D.J., Sovacool, B.K. (2020) 'Sociotechnical matters: Reviewing and integrating science and technology studies with energy social science', *Energy Research & Social Science*, 65.

Hoppe, T., Vries, G. de (2019) 'Social Innovation and the Energy Transition', *Sustainability*, 11, 141.

Horta, A. and Schmidt, L. (2021) 'Pobreza Energética: do diagnóstico à mudança necessária', *Rediteia – Revista de Política Social*, 53, 13–22.

EC-European Commission. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank. Clean Energy for All Europeans (COM/2016/0860 Final).

EC-European Commission. Regulation (EU) 2019/943 of the European Parliament and of the Council on the Internal Market for Electricity. 5 June 2019.

Gui, E.M., MacGilla, I. (2018) 'Typology of future clean energy communities: An exploratory structure, opportunities, and challenges', *Energy Research & Social Science*, 35, 94–107.

Hasselqvist, H., Renstrom, S., Stromberg, H., Håkansson, M (2022) 'Household energy resilience: Shifting perspectives to reveal opportunities for renewable energy futures in affluent contexts', *Energy Research & Social Science*, 88.

Heldeweg, M. A. and Saintier, S. (2020) 'Renewable energy communities as 'socio-legal Institutions': A normative frame for energy decentralization?', *Renewable and Sustainable Energy Reviews*, 119.

Horta, A., Gouveia, J. P., Schmidt, L., Sousa, J. C., Palma, P., Simões, S. (2019) 'Energy poverty in Portugal: Combining vulnerability mapping with household interviews', *Energy & Buildings*, 203, 109423.

Koirala, B.P., Koliou, E., Friege, J., Hakvoort, R.A., Herder, P.M. (2016) 'Energetic communities for community energy: A review of key issues and trends shaping integrated community energy systems', *Renewable and Sustainable Energy Review*, 56, 722–744.

Komendantova, N. (2021) 'Transferring awareness into action: A meta-analysis of the behavioral drivers of energy transitions in Germany, Austria, Finland, Morocco, Jordan and Iran', *Energy Research & Social Science*, 71.

Korcaj, L., Hahnel, U., Spada, H. (2015) 'Intentions to adopt photovoltaic systems depend on homeowners' expected personal gains and behavior of peers', *Renewable Energy*, 75, 407-415.

Kyprianou, I., Serghides, D. K., Varo, A., Gouveia, J. P., Kopeva, D., & Murauskaite, L. (2019) 'Energy poverty policies and measures in 5 EU countries: A comparative study', *Energy and Buildings*, 196, 46–60.

Lennon, B., Dunphy, N., Sanvicente, E. (2019) 'Community acceptability and the energy transition: a citizens' perspective', *Energy, Sustainability and Society*, 9, 35.

Lennon, B., Dunphy, N., Gaffney, C., Revez, A., Mullally, G. & Paul O'Connor (2020) 'Citizen or consumer? Reconsidering energy citizenship', *Journal of Environmental Policy & Planning*, 22(2), 184-197.

Lowitzsch, J., Hoicka, C.E., Tulder, F.J. (2020) 'Renewable energy communities under the 2019 European Clean Energy Package – Governance model for the energy clusters of the future?', *Renewable and Sustainable Energy Reviews*, 122.

UN-United Nations (2021) *Theme Report on Energy transition: towards the achievement of SDG7 and Net-zero emissions*.

UN-United Nation (2015) *Transforming our World: The 2030 Agenda for Sustainable Development*.

McGinnis, M., Ostrom, E. (2014) 'Social-ecological system framework: initial changes and continuing challenges', *Ecol. Soc.*, 19 (2).

Moroni, S., Alberti V., Antonucci, V., Bisello, A. (2019) 'Energy communities in the transition to a low-carbon future: A taxonomical approach and some policy dilemmas', *Journal of Environmental Management*, 236, 45-53.

Schaffer, A., Brun, S. (2015) 'Beyond the sun—Socioeconomic drivers of the adoption of small-scale photovoltaic installations in Germany', *Energy Research & Social Science*, 10, 220–227.

Schoor, T., Lente, H., Scholtens, B. and Peine, A. (2016) 'Challenging obduracy: How local communities transform the energy system', *Energy Research & Social Science*, 13, 94-105.

Szulecki, K. (2018) 'Conceptualizing energy democracy', *Environmental Politics*, 27(1), 21-41.

Wittmayer, J. M., Campos, I., Avelino, F., Brown, D., Doracic, B., Fraaije, M., Gahrs, S., Hinsch, A., Assalini, S., Becker, T., Marín-González, E., Holstenkamp, L., Bedoic, R., Duć, N., Oxenaar, S., Puksec, T. (2022) 'Thinking, doing, organising: Prefiguring just and sustainable energy systems via collective prosumer ecosystems in Europe', *Energy Research & Social Science*, 86.

Zawadzki, S.J., Vrieling, L., Werff, E. (2022) 'What influences public acceptability of sustainable energy policies? The crucial role of funding and who benefits', *Energy Research & Social Science*, 87.