ENERGY4ALL
Communities for positive energy districts

COMPLEX ANALYSIS ON INSTITUTIONAL AND REGULATORY FRAMEWORKS OF PEDs/ ECs

D1.1

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Deliverable

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Energy4All	Energy as a common pool resource

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Complex analysis on institutional and regulatory frameworks of PEDs/ ECs

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Statement of Originality

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Project Executive Summary

Energy4All: Energy as a common pool resource

Energy can be conceived as a public resource that should be accessible to all. The human dimension therefore plays an important role in the design and implementation of Positive Energy Districts (PEDs) and Energy Communities (ECs). In the ENERGY4ALL project, energy communities include not only a set of households producing and consuming energy, but also common users of a public resource, such as the industrial and civic sectors. By exploring different ECs elements through four pilot studies in Stavanger (Norway), Styria (Austria), Budapest (Hungary) and Rome (Italy), the project strives to provide insights into how participatory energy governance practices affect the success of PEDs/ECs.

Deliverable Executive Summary

This report is a public-facing companion to a peer-reviewed article published in the journal *Progress in Environmental Geography*, by a larger set of collaborators. All of these authors of the article are acknowledged for their common conceptual contribution, which this report promotes. The lead author has compiled the report as a public-facing summary version that is targeted to the needs of the ENERGY4ALL project in line with the planned Deliverable 1.1.

The report draws out governance and regulatory aspects of energy communities derived by assembling expertise on core human geography concepts and energy social science. These concepts are namely *space, scale and place*. These are sequentially applied to four key characteristics of energy communities, namely *local production, efficiency, storage and demand flexibility*, in relation to energy in the form of electricity as the focal vector here.

Three main insights are brought forward with implications for the governance and regulation of energy communities. While the peer-reviewed article elaborates upon these as an agenda for human geographers, here they are concisely presented for an audience of practitioners and decision-makers. The first is to *pluralise understandings of energy communities*. The second is to *spatialise perspectives on the potential of energy communities to advance just transitions*. The third is to *contextually situate technological-energy innovation strategies*. These insights should inform how energy communities are enabled, facilitated and steered.

The peer-reviewed article can be cited as follows, and is published in open-access form:
Sareen, S., Haarstad, H., Gong, H., Aiken, G., Skjølsvold, T.M., Silvester, B.R:, Popovic-Neuber, J., Stopa, M., Lindkvist, M., Pezzotta, M., Sasse, L., Shokrgozar, S., Haugland, B.T., Langhelle, O. and Inderberg, T.H.J. Watt sense of community? A human geography agenda on energy communities. *Progress in Environmental Geography* (in press). https://doi.org/10.1177/27539687241287795

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1. Introduction

There is potential for energy communities to advance just energy system transitions towards future low-carbon systems, by moving energy production and consumption to more local scales with greater proximity to each other. This report draws on vibrant debates in the field of energy geographies, among human geographers and wider energy social scientists. These scholars have conceptualised energy communities and also studied diverse emergent models in ways that can shed helpful light on governance and regulatory aspects.

Specifically, the report – like the underlying peer-reviewed article published in *Progress in Environmental Geography* – channels understanding of *space, place and scale* into future practices of enabling, facilitating and steering energy communities. In doing so, the report addresses four definitive characteristics of energy communities, namely that they concern *local production, efficiency, storage and demand flexibility* in relation to energy as electricity.

The core contribution is a table presented in Section 2, which brings together these core aspects of energy communities using the mobilised concepts from human geography. Thereafter, the conclusion in Section 3 emphasises three main takeaways that practitioners and policymakers will find useful to bear in mind when working with energy communities. These points relate to *pluralising understandings of energy communities*, *spatialising perspectives on the potential of energy communities to advance just transitions, and contextually situating technological-energy innovation strategies*. While the peer-reviewed article elaborates upon these claims for a research agenda that mainly addresses scholars, this report targets governance actors who enable, facilitate and steer energy communities.

2. Governance and regulatory aspects of energy communities

2.1 The four core aspects of energy communities understood using key human geography concepts

	Local production	Efficiency	Storage	Demand flexibility
Space	Local production in ECs exhibits geographical heterogeneity rather than uniform spatiality.	Political, technical, and economic factors modulate energy efficiency in physical space, with distributed energy production proximate to demand offering scope for efficiency.	Storage can put pressure on and completely change spatial and temporal dynamics of production and consumption, leading to new configurations of virtual and real space in terms of energy transfer and distribution.	How certain people, practices, and places can adopt flexibility, and alter consumption patterns, varies with spatial clustering and is unevenly layered on to existing societal patterns.
Place	Local production is closely intertwined with community (un)building and place (un) making.	ECs often emerge from the possibility to utilize bespoke local resource endowments, i.e., district heating, wind, and solar resource potentials, that are negotiated in places. They also concern "more than efficiency," e.g., energy injustice and energy democracy.	Energy storage and related critical materials are located somewhere. Digital technologies for storage challenge the traditional notion of "place" by emphasizing virtual and online places where data exchange occurs.	Local cultural factors both limit and enable the embeddedness (or otherwise) of practices incompatible with energy demand flexibility (e.g., routines).
Scale	Aspects of community resolutely do not scale, challenging a vertical understanding of scale in expanding ECs from single projects to higher spatial scales. Digital innovation can advance the understanding of energy production as nested and multi-scalar.	Human geography can help challenge assumptions that ECs must always look to scale in the sense of size and revenues. Local spaces/sites of justice and temporalities can be considered a "scale" which ECs may prioritize above others.	Research on ECs requires addressing the artificial bifurcation of global from local, revealing a need to critically engage with the production of scale, think relationally and be mindful of the "geographies of responsibility" and problem-shifting related to energy storage (e.g., batteries) at the trans-local scale. Storage can potentially transform the relationality of scale, between central and local production.	The interrelationship between decentralized ECs and extant structures foregrounds the multi-scalar and intertwined power dynamics related to energy demand flexibility.

Source: Authors' original work.

Figure 1: Author's understanding of the core aspects of ECs using key concepts in human geography. Source: Sareen et al. 2024. See the full reference in the deliverable executive summary (p6).

2.2 Explaining the four core aspects of energy communities in terms of relevance for governance

2.1.1 Local production

Local production is distinct from decentralized governance. It does not necessarily imply a split from higher spatial scales such as the national. Energy communities can be integrated in global value chains of energy systems.

- Part of the appeal of energy communities is that they can lead to place-specific forms of engagement and bring about novel social relations.
- Future energy geographies are configured in a continuum from existing to emergent resource infrastructures and systems of provision.

2.1.2 Efficiency

Energy communities can improve various aspects of efficiency which can aid legitimacy. They unfold within legal and economic contexts that have a bearing on their internal structures and modalities of governance.

- Shorter distance between electricity production and end-use reduces transmission and distribution requirements, hence local electricity use offers efficiency gains.
- Digitalisation holds scope to enhance the geographical spread and integration of energy communities, thus exerting influence over the market-normative paradigm.
- Efficiency is not always the main motivating factor, as normative concerns of justice, equity and more democratic control also make efficacy key alongside scaling up.

2.1.3 Storage

Configurations between virtual and real spaces are evolving in terms of the temporality of energy transfer and electricity distribution and the creation and capture of value. Transparent real-time energy data aids optimisation of flows and energy-saving.

- Energy storage and the critical materials it relies upon are located somewhere, yet digital technologies create virtual and online places for data exchange to take place.
- Each energy community must carefully take stock of its interdependencies with other regions and communities for a holistic (local *and* global) energy transition.

2.1.4 Demand flexibility

Energy demand flexibility (or demand response) complements supply-side solutions as a vital shift alongside demand reduction to advance decarbonisation of energy systems. Energy communities must build on experience with local flexible energy clusters.

- Demand-side flexibility requires effort to achieve in energy communities, in order to technologically comply with applicable regulations while linking supply and demand.
- Constellations of actors in emergent energy communities are more diverse than the actors involved in earlier local flexible energy clusters, leading to sociotechnical gaps.
- Governance solutions must be context-specific to bridge the gaps by understanding and responding to how a range of flexibility solutions can be meaningfully adopted.
- The roles of intermediaries and benefit sharing arrangements are particularly key to consider in this regard, as they can enable aggregation and rapid scaling of flexibility.

3. Conclusion: Three main insights for governance

Based on the aspects highlighted for the governance of energy communities above, in relation to their main characteristics understood through the conceptual lens of human geography, this report emphasises the three key insights offered in the peer-reviewed article.

First, there is a need for the governance of energy communities to pluralise and nuance the wider understanding of what energy communities are. This open approach has the benefit of allowing for a deeper appreciation of and engagement with the diverse potential that energy communities hold to advance energy transitions in a variety of socially just ways.

Second, an explicitly spatial perspective can enhance more popular involvement in energy transitions towards securing just outcomes through future energy systems. Such an inclusive approach is vital to develop energy communities and energy systems for the common good. Governance actors at and across multiple spatial scales can help build such engagement.

Third, it is vital to contextually situate technological-energy innovation strategies in respectful relation to the values, needs and indeed aspirations of community members in a bottom-up manner, instead of taking an incumbent-led, top-down approach that favours big-tech actors. This can nurture more diverse ownership beyond a market-normative energy sector logic.

In closing, this report emphasises the need for governance actors – be they practitioners or policymakers positioned to enable, facilitate and/or steer the development of energy communities – to interpret and operationalise the relevance of these general insights in their own mobilisation of people-centric energy communities that advance just energy transitions. In the ENERGY4ALL project, this Deliverable 1.1 serves the purpose of establishing such an orientation in our own efforts across various Positive Energy District pilot project sites, while also working outwards towards the larger task of advancing common understanding of governance and regulation in line with the crucial role these play for all energy communities.

Read the published article

Sareen, S., Haarstad, H., Gong, H., Aiken, G., Skjølsvold, T.M., Silvester, B.R:, Popovic-Neuber, J., Stopa, M., Lindkvist, M., Pezzotta, M., Sasse, L., Shokrgozar, S., Haugland, B.T., Langhelle, O. and Inderberg, T.H.J. Watt sense of community? A human geography agenda on energy communities. *Progress in Environmental Geography* (in press). https://doi.org/10.1177/27539687241287795

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Figure 2. Authors of the peer-reviewed article discussing energy communities in Stavanger. Source: Siddharth Sareen.