Energy Research & Social Science 131 (2026) 104528

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Governing beyond market and state: A grounded theory of public–commons partnerships in Spain's energy transition

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ARTICLE INFO

Keywords:
Public–commons partnerships
Energy commons
Collaborative governance
Local governments
Energy governance
Policy design

ABSTRACT

Efforts to accelerate just and democratic energy transitions increasingly look to forms of governance that move beyond the dominant logics of market competition and centralized state control. Yet little is known about how such alternative arrangements emerge, operate, and generate systemic change. This article addresses this gap by examining public–commons partnerships in Spain, a context where highly concentrated energy markets coexist with a growing landscape of municipal and community-led initiatives. Based on a qualitative study of eighteen initiatives across the country and a systematic grounded-theory approach, the research develops an inductive model that explains how these partnerships take shape and how they influence wider transformation processes. The findings show that public–commons collaboration unfolds through three interrelated dimensions: localized action rooted in eco-social values, the formation of reciprocal networks that enable coordination and learning, and governance practices that challenge incumbent power and reconfigure institutional arrangements. Together, these mechanisms illustrate how partnerships between public administrations and commons-based initiatives can expand democratic participation, strengthen territorial equity, and open pathways for systemic transformation. The article advances energy governance research by offering a theoretical framework that clarifies the dynamics of hybrid public–commons arrangements and provides practical insights for policymakers and local actors seeking to build more inclusive and sustainable energy systems.

1. Introduction

As the global energy sector faces unprecedented challenges, including climate change, energy injustices [1], and the need for popular sovereignty and participatory governance [2], the concept of Energy commons has gained increasing prominence. Energy commons, defined as community-driven initiatives to produce, manage, and distribute energy as a shared resource, offer an alternative to traditional market- and state-driven models [3–9]. They foreground the role of communities and civil society in reclaiming democratic control over energy resources as part of a broader and just socio-ecological transformation. However, achieving systemic change requires more than grassroots efforts; collaborations between public institutions and Energy commons are essential to create scalable, equitable, and sustainable energy systems. Decentralization of power has to go hand in hand with need for coordinated governance [10,11]. Despite this necessity, research on the dynamics and conditions that enable effective public-commons partnerships remains scarce, leaving a critical gap in understanding how such collaborations can address contemporary energy governance challenges.

The relevance of public-commons partnerships lies in their potential to democratize energy governance, resist market-driven privatization, and embed eco-social principles into energy systems. Public institutions, particularly at the local level, play a pivotal role in enabling these collaborations by providing institutional legitimacy, financial resources, and regulatory support [12,13]. Simultaneously, Energy commons offer innovative governance models, emphasizing participatory decision-making, local knowledge, and collective ownership [14,15]. Yet, such collaborations are fraught with challenges, including regulatory barriers, power asymmetries, and differing governance priorities between public and commons actors [16]. Understanding these dynamics is critical to realizing the transformative potential of public-commons partnerships. While existing literature has explored the theoretical foundations of commons governance [15,17] and the role of local initiatives in energy transitions [18], there is limited empirical work examining how public-commons collaborations emerge, sustain

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https://doi.org/10.1016/j.erss.2025.104528
Received 5 May 2025; Received in revised form 16 December 2025; Accepted 28 December 2025
Available online 8 January 2026

themselves, and scale.

Bollier and Helfrich introduced the concept of public-commons partnerships to describe enduring collaborations between state institutions and commons members aimed at addressing specific policy challenges [19]. Previous studies have highlighted the importance of community engagement and trust-building in Energy commons [20] but have not adequately addressed how these dynamics interact with institutional frameworks and market structures. Similarly, research on public-private partnerships often overlooks the distinct characteristics and values of commons-based initiatives, such as their emphasis on equity and human autonomy [15,21]. In recent years, significant scientific efforts have been dedicated to understanding public-commons partnerships based on notable case studies that have provided empirical insights into the potentials and risks of these collaborations [22–24]. However, a conceptual framework inductively developed—ensuring theories are deeply rooted in real-world experiences and capable of capturing the intricate dynamics of public-commons partnerships—remains absent.

To bridge this gap, this research develops a grounded theoretical model of public-commons partnership in energy systems. The study draws on the Spanish energy transition as an illustrative context, where a historically centralized electricity regime dominated by large utilities intersects with a growing constellation of municipal and community-led energy initiatives. This interplay of structural concentration and grassroots experimentation offers a fertile setting for examining how public–commons collaborations are formed, sustained, and challenged. Based on qualitative data from 18 initiatives across the country—including semi-structured interviews, document analysis, and a systematic grounded-theory approach following the Gioia methodology—the analysis uncovers the mechanisms, processes, and factors that underpin successful partnerships between public institutions and Energy commons. By revealing how localized actions can drive broader systemic transformations, the findings contribute to scholarship on energy transitions, polycentric governance [25], and commons theory, while also offering practical insights for policymakers and practitioners seeking to build equitable and sustainable energy governance. The remainder of the paper is structured as follows. Section 2 presents the theoretical framework, integrating commons theory and polycentric governance. Section 3 outlines the methodology, including case selection and data collection procedures. Section 4 details the empirical findings derived from the data collected. Section 5 develops the discussion, elaborating the emergent theoretical model. Finally, Section 6 concludes with key contributions, policy implications, and directions for future research.

2. Theoretical framework

2.1. Characterizing and operationalizing Energy commons

Energy commons are collectively governed energy systems where citizens, organized in community-based structures, play a central role in producing, distributing, storing, or consuming energy. This concept builds on the legacy of the foundational work on self-governed commons [26], and on the notion of *instituting praxis* [27], which sees the commons not just as resources but as collective, democratic processes. These initiatives aim to transcend the binary of state-centered and market-driven governance by fostering collective action rooted in values of social and ecological justice, human autonomy, reciprocity, and sustainability.

As transformative and self-organized practices, Energy commons embody the principles of *commoning* [4,28], the active, ongoing process of sharing, caring, and co-producing essential resources such as energy [29–31]. In this energy domain, different scholars [6,32–35] have highlighted the role of Energy commons as catalysts for just and inclusive energy transitions. As such, they are increasingly recognized as vehicles for advancing energy democracy by aligning energy systems with social needs, environmental sustainability, and participatory governance [36].

Building on these contributions, we operationalize Energy commons as grassroots energy initiatives that (1) embed democratic decision-making in their governance [10,37], (2) prioritize human autonomy and ecological and social justice over profit maximization [27] and (3) actively seek to transform existing energy structures through collective agency and institutional experimentation [38,39]. Rather than treating Energy commons as a fixed institutional form, we understand them as dynamic processes of collective experimentation, shaped by local contexts and broader power structures.

2.2. Integrating commons theory and polycentric governance

Commons theory and polycentric governance are complementary lenses for understanding transformative energy governance. While commons theory provides a normative and analytical framework for examining collective self-organisation in the management of shared resources [26,30], polycentric governance emphasizes the coexistence and coordination of multiple centers of authority operating at different scales [40,41]. It offers tools to understand how these bottom-up initiatives interact with a broader institutional ecosystem composed of municipalities, regional governments, national regulators, and supranational frameworks [40]. It draws attention to the dynamic interplay between autonomy and coordination, local specificity and systemic alignment. Something particularly relevant in the context of energy transitions, where multilevel coordination, institutional innovation, and actor trust are critical to overcoming lock-ins and enabling systemic transformation [42].

Energy commons are embedded in hybrid governance systems, where state and community actors could potentially co-create institutional arrangements through processes of negotiation, contestation, and alignment. Public-commons partnerships, in this sense, could represent emergent institutional forms that challenge the traditional public-private dichotomy, giving rise to new configurations of power and responsibility. This theoretical integration informs our analytical model. As we show in later sections, the dimensions identified through our grounded analysis—such as localized experimentation, inter-scalar coordination, and citizen empowerment—reflect core principles of both commons-based self-governance and polycentric institutional design. By foregrounding this intersection, our study contributes to the exploration of how democratic, decentralized, and multi-level governance models can advance just and sustainable energy transitions.

3. Methodology and data

This study employs a qualitative research design based in the Gioia Methodology, an approach particularly suited for developing grounded theoretical models in complex organizational and social systems [43–45]. This inductive approach is particularly suitable for exploring under-theorized socio-institutional phenomena such as emerging public-commons partnerships [46,47]. It enables the construction of conceptual models from empirical data, rather than testing predefined hypotheses, allowing us to remain close to participants' experiences while identifying broader patterns and mechanisms. To structure our analytical process the Gioia Methodology offers a systematic procedure for developing grounded theoretical insights while preserving transparency and rigor [44]. By focusing on the dynamics of public-commons partnership in Spanish energy system, this study uncovers the nuanced processes, interactions, and factors that enable or constrain these partnerships. Particularly, the Gioia Methodology was selected due to its capacity to systematically capture and analyze qualitative data while generating theoretical insights.

At the outset of the study, we followed a four-step sequential research design: (1) identification and preliminary assessment of potential initiatives across Spain, (2) selection of 18 initiatives aligned

with commons-based principles, (3) a round of semi-structured interviews with key actors from these initiatives, and (4) document analysis to triangulate interview data specifically on governance arrangements, institutional and regulatory conditions, and the socio-ecological aims and practices of the initiatives.

3.1. Contextual overview of the Spanish energy system

Spain's energy system is characterized by a decentralized structure in which autonomous communities and municipalities play a growing role in energy planning and implementation [48]. While national regulation, overseen by the Ministry for the Ecological Transition and the CNMC (National Commission for Markets and Competition), sets overarching frameworks for energy markets, regional and local administrations have gained competencies in energy efficiency, renewables, and urban sustainability [49].

The sector has historically been dominated by a small number of large incumbent firms resulting in a highly concentrated oligopolistic market. This concentration has led to criticisms regarding regulatory capture, limited competition, and barriers to citizen-led initiatives [50]. These actors have traditionally maintained close ties to the state and exert significant influence over regulatory design, often constraining the emergence of alternative models [51]. However, recent years have seen a proliferation of grassroots energy initiatives, particularly energy cooperatives and local public enterprises, driven by ecological concerns and demands for democratic governance. Energy cooperatives in Spain are legally recognized entities, though they often operate under restrictive regulatory and financial conditions. Despite supportive EU frameworks, national transposition has sometimes created obstacles for community energy [52]. Municipalities have emerged as key actors in supporting or blocking these initiatives, depending on their political orientation and institutional capacity.

3.2. Data collection

Data were collected from a variety of stakeholders involved in Energy commons initiatives, public institutions, and intermediary organizations to ensure a comprehensive exploration of the phenomena (Table 1). Interviews involved a purposive sample of stakeholders, ensuring diverse representation across local, regional, and national levels. Participants included members of Energy commons initiatives such as cooperatives and local community groups, representatives of public institutions including municipal and regulatory bodies, and actors from intermediary organizations like advocacy networks and research institutions. Using secondary resources, including official platforms and external publications, an initial pool of 40 initiatives was identified for review. From this group, 18 were selected for deeper examination based on their alignment with the Commons paradigm; specifically, their adherence to principles such as democratic governance, collective ownership, ecological and social orientation, and active community participation. This selection enabled a round of interviews to be conducted. To address the variability and inconsistencies in data across sources, a refined set of five robust primary references was utilized to streamline the selection of case studies: (1) the 2020 study by Caramizaru and Uihlein for the European Commission's Joint Research Centre [53], (2) the Interreg Europe-supported enercommunities.eu repository, (3) the Friends of the Earth guides [54,55], (4) the Energy Communities viewer, developed by the Spanish Ministry of Ecological Transition and Demographic Challenge in collaboration with IDAE, and (5) *Unión Renovables*, representing Spain's renewable energy cooperatives federation.

As a usual form of Energy commons [53], four of the selected cases are energy cooperatives. Nonetheless, Energy commons come in various forms. To ensure a broader representation, additional cases were included that diverge from the cooperative model, incorporating diverse infrastructures, governance approaches, and participant profiles. To facilitate this broader exploration, supplementary sources were consulted, including: (1) the Energy Communities Network, which highlights initiatives and success stories; (2) the Iberian Network of Ecovillages (RIE); (3) the Platform for a New Energy Model (Px1NME), a Spanish citizen-led initiative promoting an equitable and sustainable energy transition; and (4) the *Transition Network*, a collection of grassroots projects aimed at fostering local resilience to address challenges such as peak oil, climate change, and economic uncertainty. A summary table included in Annex A offers an overview and brief description of the 18 initiatives that were ultimately selected for semi-structured interviews. Each interview lasted between 60 and 90 min.

Table 1
Typology and number of initiatives interviewed in the study.

Code	Initiative type	Description	N° of initiatives interviewed
INA	Integral Self-governed Communities (e.g., ecovillages, Transition Towns)	Grassroots community initiatives with a holistic approach to sustainability, often including energy, food, housing, and education. Self-governed and collectively managed.	7
CER	Renewable Energy Cooperatives	Cooperatives focused on the production and management of renewable energy, based on democratic governance and community participation.	4
ESO	Social Enterprises	Horizontally governed enterprises oriented toward social impact in the energy sector promoting decentralized energy models.	2
IMU	Public Initiatives	Local public institutions and municipal companies aiming to foster energy autonomy, citizen participation, and territorial equity.	2
ASO	Foundations and Non-profits	Foundations, research institutions, and advocacy organizations facilitating knowledge exchange, support, and scaling of Energy commons.	3

Across all cases, interviewees were selected based on their central involvement in the initiatives under study. In every instance, participants belonged to the core group of each project, possessing long-standing experience and in-depth knowledge of their respective initiative's evolution, internal governance dynamics, and external collaborations with public institutions, networks, and other actors. The interviews followed a common semi-structured guide that allowed for comparability while remaining flexible to contextual nuances. The main topics explored included: (1) the origins and trajectories of the initiatives; (2) internal governance structures and decision-making processes; (3) motivations, values, and socio-environmental objectives; (4) experiences of collaboration with public actors at local, regional, and national levels; (5) enabling and constraining regulatory and market conditions; (6) use of technology and infrastructures; and (7) perceived challenges and opportunities in advancing democratized, sustainable energy systems through public-commons partnerships.

To provide additional contextual depth and enhance analytical triangulation, we conducted a document analysis that included policy reports, project evaluations, and academic literature. These documents were identified through a combination of purposive online searches—targeting official platforms (e.g., IDAE, MITECO, and municipal portals), repositories of EU-funded projects, and academic

databases—as well as materials shared by interview participants during or after the interviews. The relevance of each document was assessed based on its capacity to (1) describe governance arrangements involving public and/or commons actors, (2) reflect on institutional, legal, or political enablers and barriers, and (3) provide insights into the socio-ecological objectives, practices, or impacts of the initiatives studied.

3.3. Data analysis

The Gioia approach unfolds in three iterative stages (Table 2). First, we conducted open coding to derive *first-order concepts* that closely reflect the language and observations of participants (e.g., "tailoring solutions to local needs" or "fostering trust through shared governance"). Second, we identified second-order themes, which involve more abstract, theoretical interpretations that begin to explain the dynamics underpinning public-commons collaboration (e.g., "Responsive local action" or "Challenging privatization and marketization"). Finally, these second-order themes were grouped into aggregate dimensions that synthesize the overarching processes revealed in the data, namely: "*Localized action and eco-social transformation*", "*Collaborative networks and strategic alliances*", and "*Governance, power, and advocacy*". This structured, layered coding process helped us build an emergent theoretical model that captures the institutional and relational patterns characterizing transformative public-commons partnerships in the energy sector.

This methodology has not only highlighted critical insights but has also facilitated a deeper exploration of the diverse perspectives and priorities of stakeholders involved in these initiatives. By systematically organizing and analyzing qualitative data, the Gioia Methodology has allowed us to uncover nuanced elements that shape successful collaborations, including trust-building, shared goals, power dynamics, and mutual accountability.

The emerging theoretical model was reviewed by experts in energy governance and commons-based frameworks ensuring the model's accuracy and alignment with practical realities. Reflexivity was maintained throughout the research process, with researchers documenting potential biases and analytical decisions. Thick descriptions, including verbatim quotes, were used to provide a detailed contextual understanding of the findings. Additionally, an audit trail was maintained to document coding processes, memos, and theoretical developments, enhancing transparency and replicability. Ethical guidelines for qualitative research were rigorously followed. Participants were provided with detailed information about the study's objectives, confidentiality measures, and their right to withdraw at any time. Participation was entirely voluntary, with no coercion or incentives offered.

4. Results

Summarized in Table 2, the Gioia Methodology has provided a Data Structure to identify the key factors that interviewed initiatives consider essential for understanding and fostering public-community collaboration. These findings are instrumental in designing policies and strategies that enhance synergy between public administrations and community-led initiatives, paving the way for more sustainable and inclusive governance models.

4.1. Localized action and eco-social transformation

The findings underscore the critical role of localized initiatives as the foundation for public-commons partnerships, where immediate community needs intersect with broader systemic transformation. These initiatives highlight how proximity, adaptability, and eco-social principles drive the emergence of innovative governance models that challenge conventional energy systems.

Table 2
Data structure.

1st order concepts	2nd order themes	Overarching categories
• When community initiatives are very small, they gain flexibility and speed. The municipal scale is the most suitable for identifying and responding to citizens' needs. • From the local level of action of community initiatives, it is difficult to have a clear view of global challenges. The local scale has limits in addressing challenges that have reached a global scale. • The size of a community initiative must match the size of the community it serves. • Community initiatives prioritize small-scale collaboration without needing to grow in size. They must remain small to preserve their levels of participation and democracy.	Responsive local action: addressing citizen needs through proximity and flexibility	Localized Action and Eco-Social Transformation
• By operating at the local scale, community initiatives are able to promote values such as sufficiency. • Community initiatives believe it is necessary to experiment today with new forms of energy governance so that, in the future, an alternative public system can be established. • Energy community initiatives firmly believe that certain goods must be public and serve society. What matters in management is that it serves society. • Once a community initiative is launched, in goods like energy, it is relatively easy to extend its activities to nearby areas.	Transforming local energy systems through eco-social values and collective praxis	
• Scaling up requires community initiatives to redefine their governance models. • Community initiatives must be able to combine local action with global impact. • For a local initiative, it is challenging to determine the best way to address global challenges, whether by growing larger or by building networks.	Balancing local and global dynamics	Collaborative Networks and Strategic Alliances
• When local public administrations convey trust, collaborating with them enhances the appeal of community initiatives. • Community governance of goods and services also involves managing conflicts between initiatives with differing visions.	Building social capital through trust, conflict, and shared vision	

(*continued on next page*)

Table 2 (*continued*)

1st order concepts	2nd order themes	Overarching categories
• In collaboration with public administrations and among community initiatives themselves, it is crucial to have a shared vision. • Communication is not enough; spaces must be created to foster mutual understanding and collaboration. • Community initiatives gain greater credibility through the presentation of real projects and actions. • Community initiatives should seek commitment, activation and enthusiasm through joint activities. • Community initiatives must build higher levels of trust in society through communication, the attainment of certifications, shared experiences and common spaces. • Community initiatives should strive to increase participation by communicating with non-engaged groups and individuals. • Engagement with community initiatives requires mutual understanding and time. • In contrast to competition, community initiatives in the energy sector aim for collaboration. • Collaboration with public administrations is often on an individual basis; collaboration with communities must be promoted. • Collaboration between community initiatives and public administrations requires both sides to make concessions. • Public administrations must safeguard energy as a public good serving society. • Public administrations remain the best institutions to ensure universal access to basic services. • Community initiatives point out that collaboration is complex when we have been educated in competitiveness. • The possibilities for collaboration between community initiatives and public administrations are influenced by the socioeconomic characteristics of the territory. • Whenever they are willing, municipal public administrations create spaces for community governance of energy.	Fostering collaboration over competition for advancing common goods across communities and institutions	
• Some community initiatives possess the scale, capacities, and resources needed to do what others cannot and to pave the way forward. • Collaboration with public administrations or other emerging community initiatives should aim to empower them, providing tools to help them manage more effectively, improve processes and strengthen both parties mutually. • Collaborative networks are composed of heterogeneous community initiatives. • Community initiatives aim to be open and avoid excessive dependence on public administrations. • Community initiatives are compelled to collaborate with one another and with public administrations because they lack sufficient resources individually. • Through collaboration, local public administrations have managed to create federated networks that transcend the local scale. • To achieve the desired social transformations, it is important for community initiatives to connect with nearby and local initiatives. • Collaboration should occur between the different levels of public administrations: state regulation alongside municipal initiatives.	Reciprocal and diverse collaborative networks for local and global capacity building	
• Due to regulatory divergences, it is challenging for community initiatives to expand their activities to other countries, even neighbouring ones. • The power of large electricity companies influences the decisions of other businesses and public administrations. • Community initiatives are highly vulnerable to political changes within public administrations. • The participation of community initiatives in the development of public regulations increases their commitment to compliance. • Community initiatives distrust that the political will is necessary to transform reality. • Community initiatives distrust the way public administrations and business fabric manage and allocate resources and regulate the energy sector. • Community initiatives propose new actions in	Adapting and advocating: community responses to regulatory and power concentrations	Governance, Power, and Advocacy

(*continued on next page*)

Table 2 (*continued*)

1st order concepts	2nd order themes	Overarching categories
response to impacts arising from regulatory changes. • Community initiatives aim to avoid dependence on financial institutions to retain control over their own decisions. • Community initiatives have the potential to drive regulatory changes by presenting real initiatives. • Market regulations make it difficult for municipal public administrations to put energy at the service of citizens. • Regulations from public administrations are a valuable tool for achieving changes in public behaviour. Changes in regulations by public administrations could facilitate the emergence and consolidation of community initiatives. • Both due to its regulation and the concentration of power, the energy sector is a challenging area for launching community initiatives. • Due to its structure, but also because of current societal demands, the state has ceased to represent society. • Democratization of public administrations through collaboration with community initiatives. • Private management relentlessly commodifies energy, and public management finds it very difficult to maintain political commitments over time. • Public management of energy is more democratic than private management. • Public management does not have to be state-run; there are other models. Community initiatives advocate for alternative forms of public governance. • Community initiatives aim to generate their own energy to avoid dependence on market conditions. • Community initiatives believe it is possible to reverse the processes of privatization and commodification if local public administrations have the will to do so.	Challenging privatization and marketization through public-community collaboration • Unlike those at higher levels, municipal public administrations treat energy as a public good and are easier to control democratically. The local level is effective because it is where there is direct contact with society. • At the municipal level, having a medium- to long-term strategy is crucial for transforming the local energy model. • Technologies currently exist that enable the local distribution of energy governance. • Public governance of a good must involve citizen participation in decision-making. Community initiatives aim precisely to have energy recognized as a public good, with citizens at the centre of its governance. • In the coming years, community energy initiatives expect to have a greater presence in the sector. Democratizing energy through local governance • Technologies currently exist that enable the local distribution of energy governance. • The ownership of technologies and resources is a central issue when it comes to ensuring that energy is a public good serving society. • Energy community initiatives seek to have citizens, inclusively, regain control of energy governance.	Reclaiming citizen power in the face of technological opportunity

4.1.1. Responsive local action: addressing citizen needs through proximity and flexibility

Localized action prioritizes proximity and responsiveness, enabling Energy commons to design solutions tailored to the unique social, economic, and environmental contexts of specific communities. “If you ask me about one of Ecooo's advantages is at different levels, I would say flexibility. We are very small, we are very flexible, and we are very fast. In fact, we have a huge reaction capacity since we are really small” (ESO1). This need of flexibility and adaptation becomes necessary:

> We are now making a shift in this direction. When we develop a project, we first consider, before actually doing it, what citizens want. We try to address this in the project and present it to them before implementing it. This represents a radical change. And it is costing us a lot because we were not used to working this way. But it is the way we work, we can't work any other way because society is changing (IMU1).

What this shows is that adaptation capacity is mandatory for these local initiatives if they want to survive in an ever-changing and volatile context. By fostering close interactions and understanding local realities, these initiatives build trust and a sense of ownership among community members. This trust is a key driver of collaboration with public institutions, as it aligns local actions with institutional goals. The inherent flexibility of such localized approaches enables swift adaptation to evolving community needs, enhancing the credibility and relevance of Energy commons within public frameworks.

4.1.2. Transforming local energy systems through eco-social values and collective praxis

Energy commons operationalize eco-social values—such as sufficiency, equity, and inclusivity—through participatory governance and collective action. They consider that “(…) communities close to the territory are capable of developing other values such as self-restraint or sufficiency” (INA3). These principles prioritize the collective welfare of the community, contrasting sharply with market-driven energy models. By embedding these values into their operational practices, Energy commons serve as experimental laboratories for systemic innovations, providing tangible demonstrations of how eco-social principles can be integrated into broader governance frameworks. These initiatives illustrate that energy can function as a common good rather than a commodified resource.

The need for a paradigm shift is highlighted among the Energy commons (INA7, IMU2, ASO3). In contrast to “the liberalization of public goods and that the main objective is to guarantee competition and the market, as if that were an objective in itself. What we [Energy commons] are saying is that it is not the objective. We need to change our mindset and focus on guaranteeing basic goods” (INA7). The interplay between responsive local action and the integration of eco-social values reveals a dynamic process in which immediate community

needs act as catalysts for experimentation in governance and sustainability. Localized initiatives address urgent issues while creating frameworks that align grassroots solutions with broader societal objectives. This synergy demonstrates the potential of Energy commons to act as innovation hubs, providing public institutions with actionable models that incorporate community-driven priorities and governance approaches. Especially considering that energy should be considered as *"a public utility good"* by public administrations (ESO2, ASO2, ASO3), this synergy between localized initiatives and public institutions is increasingly crucial.

> Energy must be part of the political discussion. And I believe that in all the initiatives we have implemented, both on the issue of self-consumption and in opposing the tax to solar energy, the majority in Parliament has a completely different energy vision than the one that the current government has. And I think that this is important (ASO3).

Localized initiatives thus offer public institutions a dual advantage: they respond effectively to immediate challenges and serve as test beds for embedding systemic change. By leveraging the lessons and models emerging from these grassroots efforts, public institutions can align their strategies with societal goals for equitable, inclusive, and sustainable energy systems. This alignment highlights the transformative potential of public-commons partnerships as a pathway for addressing global energy challenges through localized, community-centered approaches.

4.2. Collaborative networks and strategic alliances

The findings emphasize the transformative role of collaborative networks and strategic alliances in scaling localized initiatives into systemic changes. These networks enable Energy commons to transcend local boundaries, acting as conduits for knowledge and capacities sharing, resource mobilization, and policy alignment. By integrating diverse actors and fostering mutual trust, collaborative networks lay the foundation for more resilient and impactful public-commons partnerships.

4.2.1. Reciprocal and diverse collaborative networks for local and global capacity building

Diverse networks enhance the capacity of Energy commons by facilitating the exchange of knowledge, tools, and strategies that are adaptable to varying contexts. These networks provide a bridge between local initiatives and global frameworks, enabling Energy commons to leverage resources and insights from multiple scales. "Personally, we think that it is a good idea that this working procedure is generalized and expanded to groups made up of few people who are working upon precise issues and who can develop a similar activity. Not necessarily in the field of energy" (INA7). Opening up networks to other sectors apart from energy allows members to develop a holistic and multi-faceted understanding of initiatives with similar challenges.

For these initiatives to survive, an essential aspect is that "we [Energy commons] feel a very strong change when we take part in networks. Firstly, because each project needs to have a very strong influence level at a local scale. It is very difficult for a project to survive if it is made up of few people with no connection to nobody from their environment (…) This is the key of success" (INA1). By maintaining the specificity of local governance while connecting to broader frameworks, these networks enhance the scalability and resilience of public-commons partnerships, facilitating the creation of formal and informal exchanges of knowledge that will strengthen these partnerships. The networking connections can relate both local initiatives between themselves and with public administrations.

> We are working with three different villages, one from the Basque Country, one from Catalonia and another from Cáceres. And it is all about that, about connecting eco-social movements with the institutions to build bridges, to show them how to work together empowering the people too. And that the city council delegates that power on the people because they see that we are capable of running this (INA2).

This alignment ensures that localized solutions are not only replicable but also sensitive to regional differences, fostering an adaptive and polycentric approach to governance [25].

4.2.2. Balancing local and global dynamics

Public-commons partnerships must navigate the inherent tension between local specificity and global challenges. The findings reveal that effective partnerships achieve this balance by ensuring that local governance retains its autonomy while simultaneously contributing to overarching eco-social objectives. "One of the things proposed this year as part of this restructuring was to give these territorial sections and local groups more autonomy in a manner defined in the statutes" (CER2). Even being less confident in influencing the global level than the local level, they feel the need to strike a balance between both dynamics (INA1).

These dynamics underscore the importance of feedback loops, where localized actions inform global strategies and, conversely, global frameworks support local adaptations. This iterative relationship strengthens the impact of public-commons partnerships, enabling them to address both micro and macro-level challenges in energy governance. The advantage is that this public-common partnership can take place at collective level, at municipal level or in various ways without them being necessarily controlled by the State (ESO2, CER1, CER4).

4.2.3. Building social capital through trust, conflict, and shared vision

Trust-based relationships are fundamental to the success of collaborative networks. Social capital, cultivated through shared visions, conflict resolution, and meaningful engagement, aligns diverse stakeholders under unified goals. One of the keys to achieve this social capital is that "communication has always to be transparent, ensuring that another group or person can raise an objection to a certain decision. Then we would discuss it" (INA1). Transparency is also highlighted by other initiatives as a key factor and serves to create "confidence" among group members that will further strengthen confidence in the initiative (ASO1, ASO2, INA2).

The findings highlight that effective collaborations often emerge from overcoming initial tensions, where diverse actors negotiate their priorities and develop mutual respect. "The fact that we get together informally and like a group of friends has allowed us to resolve any conflicts that may arise between us before they become a giant, difficult-to-resolve problem" (INA5), since we are talking about human communities where "we can't imagine life in peace and without any conflicts. Community life brings about conflicts that need to be solved" (INA1). This process not only strengthens the network but also enhances its capacity to navigate complex challenges and sustain long-term partnerships.

4.2.4. Fostering collaboration over competition for advancing common goods across communities and institutions

Collaboration over competition is a defining characteristic of successful public-commons partnerships. By prioritizing collective benefits over competitive individualism, these collaborations align the goals and resources of Energy commons and public institutions. This alignment fosters synergies that amplify the collective impact of the partnership, enabling the realization of shared objectives such as sustainability, inclusivity, and equitable energy access. These partnerships redefine success beyond profit, emphasizing the value of community-driven approaches to common goods.

> If we [the Energy commons] participate within the social State, the parameter within which we operate, is not competition but collaboration. I am not fighting with another cooperative. My objective is

not the cooperative itself. For its members, Som Energia is a tool that is not promoting the cooperative project itself, but rather an active tool for change and fostering an energy transition (CER2).

A paradigm shift is necessary, given that "this, which is our DNA, has led us to understand that the degradations of the capitalist economy are competition between companies. This fosters individualism and consumerism. In contrast, we understand that what the new paradigm fosters are relationships of cooperation and collaboration" (ESO1). However, the main difficulty is to move away from "education logics" (CER4, ESO1) that have shaped mentalities prioritizing competition in society.

The interplay among these themes reveals a dynamic and iterative process. Collaborative networks reduce fragmentation by providing platforms for diverse actors to align their strategies and resolve conflicts. They enable the flow of resources and knowledge across scales, ensuring that local efforts contribute to and benefit from global initiatives. Simultaneously, trust-based social capital and a shared commitment to collaboration strengthen the resilience and adaptability of these networks, creating the conditions for systemic change. Through these mechanisms, collaborative networks not only scale the impact of localized Energy commons but also serve as a backbone for systemic transformation. By integrating diverse perspectives and fostering collective action, public-commons partnerships can address the multifaceted challenges of the energy transition, advancing both local and global sustainability objectives.

4.3. Governance, power and advocacy

The findings highlight governance reforms and advocacy as pivotal for sustaining public-commons partnerships and fostering systemic energy transformation. These elements challenge entrenched power structures, democratize decision-making processes, and resist the commodification of energy systems. Together, they outline a cohesive framework for embedding equity, transparency, and inclusivity into energy governance.

4.3.1. Democratizing energy through local governance

Democratic governance structures emerge as foundational for effective public-commons partnerships. By empowering communities to actively participate in decision-making processes, these structures ensure that energy systems align with public interests and respond to citizen needs. "At the municipal level, you can identify the specific problems of each citizen" (IMU1). In this regard, it should be highlighted that "if we can produce energy locally, we can also manage it locally" (ASO2), as the particularities and nuances of the municipal scale will be better understood at a local level.

Local governance mechanisms provide a platform for communities to shape policies, oversee resource allocation, and prioritize sustainability over profit. "We [Energy commons] understand that the local level is the natural setting for the development of many of the policies that affect sustainability. And that, regardless of regional and state frameworks, it is where we can truly be effective. Because it is where we connect with society" (ASO2). The findings illustrate that this inclusivity not only strengthens public trust but also embeds democratic principles into energy governance, offering a viable alternative to top-down or profit-driven models.

4.3.2. Reclaiming citizen power in the face of technological opportunity

Citizen appropriation of technology plays a transformative role in energy governance. By fostering transparency and accountability, citizen-driven technological solutions enable communities to challenge market-dominated governance structures.

> One can obviously achieve a 100 % renewable system in many ways. But a 100 % renewable system is technically incompatible with a system dominated by an oligopoly. Not only because the oligopoly clearly has no interest, at least in the medium term, in moving toward a 100 % renewable system, but also because there are a series of technical constraints that mean a 100 % renewable system won't be able to function, at least as long as the current rules of the game remain in place (INA7).

Hence, the need to influence and determine the rules of the game depends on a bigger involvement in the energy sector by both local initiatives and ultimately the citizenship. The findings underscore how access to and control over technology empower communities to influence energy systems, democratizing processes that were previously monopolized by centralized entities.

> The bottom line was wanting to regain social or democratic control over a good we consider common, which is energy. Especially since, in the current situation with distributed renewables, it is feasible, more or less, for organizations like town halls or neighborhoods to generate their own electricity and not depend on increasingly larger and more uncontrollable organizations (CER1).

As we are speaking about "means of energy production, their control implies power. The issue is how that power is controlled" (INA7). This technological empowerment not only enhances governance but also creates pathways for public-commons partnerships to advocate for energy as a shared public good.

4.3.3. Challenging privatization and marketization through public-community collaboration

Public-commons partnerships serve as a counterforce to the commodification of energy systems, advocating for their recognition as a public good. "If there is an awareness that there are goods that belong to everyone and are being plundered by a few small but powerful interests, there may even be an appropriation of common goods. What was once common, or what has never been common, can become common" (INA7). By resisting privatization and marketization, these collaborations expose the limitations of profit-driven energy systems, particularly their inability to ensure equity and accessibility.

> We are moving in a different direction. I think we have overcome capitalism and state control (…) We believe we must commit to a mature society where a third party leads the processes. A hybrid of the public and the collective. Where citizen participation takes on importance, and citizens cease to be administrators or clients and become responsible, active, and co-deciders. And this proves efficient, effective, and inclusive. And when you are included, you participate and give your best (ESO1).

At this point, the potential of public-commons partnerships is recognized in a powerful way by saying "what you are telling me is very interesting, because we are also working on this. We are working on the interaction between the public and the common. The public as it was previously understood, the phenomenon of new municipalism, and how agents, movements, or practices like yours can also help generate more democratic tactics, while also attracting the public sector" (ESO1). The findings reveal that public-community partnerships actively propose alternative governance models grounded in inclusivity and sustainability, demonstrating the feasibility of energy systems that prioritize collective welfare over corporate interests.

4.3.4. Adapting and advocating: community responses to regulatory and power concentrations

Energy commons demonstrate adaptability in navigating regulatory environments while advocating for policy reforms that support their initiatives. These efforts enable Energy commons to scale their impact and challenge entrenched power dynamics, fostering more inclusive and equitable energy governance.

One of the distinct features of the Spanish energy sector lies in the fact that "the political power that this oligopoly has is enormous.

Because we are talking about one of the strategic sectors of the economy, where there is a huge concentration of capital, which also leads to a huge concentration of power. The influence these large companies have over the State is so great that they have finally allowed legislation to be created for the oligopoly" (INA7). An aspect shared by participants that point to lobbying and extensive use of public money to enrich private sector's major players as practices that illustrate the previous situation (INA7, CER2, ASO1), while enforcing "crippling legislation" (CER1, ASO1, ESO2) against the interests of local initiatives. Asymmetries of power in the Spanish energy sector shape not only the regulatory environment but also the discursive terrain in which Energy commons operate. Participants describe a persistent tension between centralized, profit-driven logics and local, citizen-led experimentation. Therefore, gaining leverage with municipal public administrations through partnerships represents an excellent alternative for commons, although as it has been said this is a road fraught with difficulties.

The findings indicate that effective advocacy not only amplifies the voice of Energy commons within policy frameworks but also ensures that regulatory changes reflect the values and priorities of community-driven energy systems. In order to avoid the disruptive impact of legislation in their activity, local initiatives need to protect themselves:

> We always try to coordinate two activities that we consider essential. Firstly, we have the whole issue of political awareness. Because while we believe it is necessary to change the habits, or improve certain habits of citizens, great things can also be achieved through certain legislation. Secondly, it is important for someone to always keep an eye on what's going on in the offices, both at the European, international and national levels. Because that can ultimately have an impact even on the municipal legislation of any municipality (ASO1).

The dynamic interplay between these themes reveals a system of mutual reinforcement that drives systemic energy transformation. Citizen-driven technological appropriation complements democratic governance by creating transparent and participatory processes. Together, these mechanisms empower public-commons partnerships to resist privatization and advocate for energy systems rooted in equity and inclusivity. Simultaneously, policy advocacy by Energy commons amplifies their influence, ensuring that governance reforms reflect eco-social values.

This interconnected framework highlights the importance of governance innovations in embedding equity and sustainability into energy systems. Localized initiatives provide a foundation for systemic change, while collaborative networks scale these efforts and align diverse stakeholders. Governance reforms, driven by citizen empowerment and policy advocacy, challenge privatization and marketization, offering actionable insights for Energy commons and public institutions. These findings contribute to a nuanced understanding of the mechanisms that enable effective public-commons partnerships, providing a roadmap for achieving equitable and sustainable energy governance.

5. Discussion

Built upon the data structure and in line with the Gioia methodology, in this section we articulate and elaborate a grounded theoretical model to elucidate the dynamics of public-commons partnerships in energy systems (summarized in Fig. 1). The findings explore how these partnerships emerge, sustain themselves, and enhance their effectiveness, focusing on the interplay between localized initiatives and broader systemic structures. By doing so, the model provides insights into how public institutions and Energy commons can collaboratively address complex energy governance challenges. This section discusses the relationships between second-order themes, identifies critical transitions, and highlights the practical and theoretical implications of our findings. These themes are central because they capture the core mechanisms and patterns that emerged across cases, providing the most meaningful level from which to understand how public-commons partnerships develop and shape systemic change.

The emergent theoretical model conceptualizes public-commons partnerships as a dynamic system structured around three interrelated dimensions: localized action and eco-social transformation, collaborative networks and strategic alliances, and governance, power, and

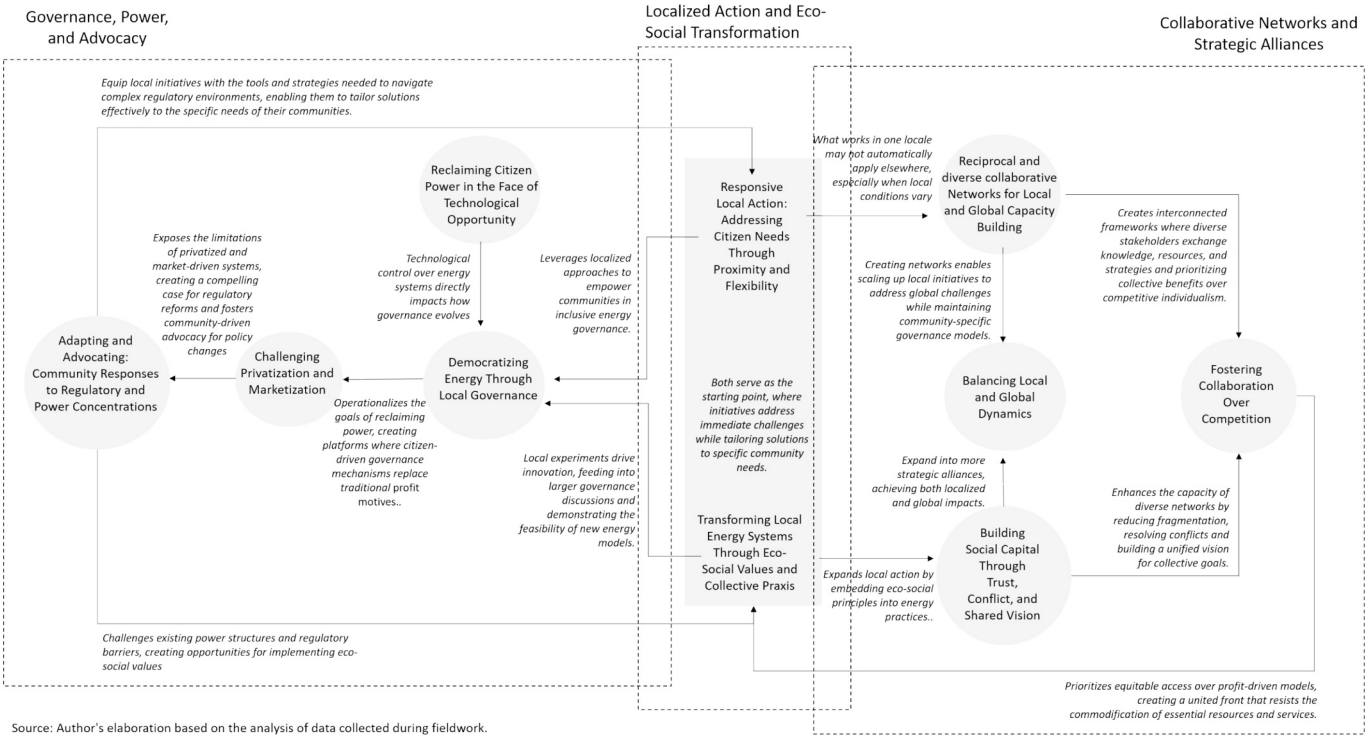

Fig. 1. Emergent theoretical model: Dimensions and mechanisms of public-commons partnerships in energy systems.

advocacy. Rather than operating as discrete components, these dimensions form an iterative process through which grassroots initiatives generate localized innovations, scale them through reciprocal networks, and consolidate them via governance reforms and political advocacy. Localized experiments create the foundational practices and values; networks enable their expansion, mutual learning, and cross-territorial alignment; and governance processes institutionalize these innovations while contesting entrenched power asymmetries. Together, these mechanisms explain how public-commons partnerships emerge, stabilize, and shape systemic change. The model is designed both as an analytical framework for scholars examining hybrid governance arrangements and as a practical tool for local governments, public agencies, and community energy initiatives seeking to design, strengthen, or evaluate collaborative pathways toward democratic and sustainable energy systems.

5.1. Localized action as the foundation for public-commons partnership

Localized action is central in initiating public-commons partnerships. Second order themes *Responsive local action: addressing citizen needs through proximity and flexibility* and *Transforming local energy systems through eco-social values and collective praxis* highlight the importance of addressing immediate, community-specific needs while embedding sufficiency and inclusivity values into local collective action. These foundational efforts serve as experimental grounds where new governance models and technological solutions are tested.

Localized action fosters trust and belonging within communities, creating a foundation for broader collaboration. For public institutions, these localized efforts provide practical examples of how Energy commons align with societal needs and regulatory goals. Thus, public institutions are encouraged to engage with these grassroots experiments to enhance their legitimacy and effectiveness. This finding aligns with prior research on Commons about the value of local knowledge and participatory governance in fostering sustainable transitions [1,15]. By bridging grassroots initiatives and institutional frameworks, localized action becomes a catalyst for systemic transformation toward more inclusive and adaptive governance models.

5.2. Scaling local solutions to address broader challenges

Our findings illustrate how localized actions scale into broader systemic changes through collaborative networks. The theme *Reciprocal and diverse collaborative networks for local and global capacity building* highlights how networks act as conduits for knowledge and capacity transfer, enabling communities to adapt their solutions to diverse contexts while maintaining local specificity. Additionally, *Balancing local and global dynamics* emphasizes the need for public-commons partnerships to address global energy challenges without compromising local governance autonomy.

These dynamics underscore the importance of feedback loops between local and global levels. Localized experiments generate insights that inform broader frameworks, while global networks provide resources and strategies that support local adaptation. This bidirectional relationship enables not only the diffusion of successful practices but also the mutual learning between governance scales. It supports the emergence of institutional diversity and adaptability—key features of resilient governance systems [25]. In the context of public-commons partnerships, such feedback loops facilitate the alignment of citizen-led initiatives with broader public policies, while preserving their autonomy and context-sensitivity. They allow for iterative co-evolution between bottom-up experimentation and top-down support structures. Ultimately, this interplay fosters a dynamic equilibrium where transformation and adaptation are continuously reinforced across scales contributing to both systemic change and local empowerment.

5.3. The interplay between technology and governance

Technological control emerges as a critical factor in shaping governance structures within public-commons partnerships. The theme *Reclaiming citizen power in the face of technological opportunity* demonstrates how citizen-driven technological solutions foster transparency and accountability, enabling communities to influence energy governance. This technological empowerment directly supports *Democratizing energy through local governance*, as communities leverage technology to participate actively in decision-making processes. Thus, a collaboration between commons and public administration, with the potential to democratize political and economic governance [56], can be significantly strengthened through the communities' appropriation of technology and the collective socialization of the means of production. The findings reveal that citizen-controlled technologies not only contribute to democratize energy systems but also challenge traditional governance structures dominated by market forces. By embedding transparency and equity into energy governance, these technologies reinforce public-commons partnerships, offering an alternative to privatized and profit-driven models.

This resonates with emerging literature on the role of technology in enabling participatory governance [14,57]. Recent research has highlighted the pivotal role of open-source and commons-based technologies in expanding access to clean energy and enabling bottom-up innovation. Open-source hardware and software ecosystems allow for greater transparency, interoperability, and adaptability to local contexts. They reduce entry barriers, lower costs, and support real-time participatory decision-making [58]. Moreover, the open-source model facilitates mutual learning and cooperation across diverse stakeholders, reinforcing commons-based governance. By combining digital platforms, energy cooperatives, makerspaces, and distributed manufacturing, these initiatives not only have the potential of democratizing energy governance but also advance energy justice by challenging the dominant, market-led green growth paradigm [59] that can open the door for “green-washing” policies [60]. Our findings reinforce this transformative potential of citizen appropriation of open technologies in public-commons partnerships.

5.4. Challenging privatization and marketization through collaboration

The themes *challenging privatization and marketization through public-community collaboration* and *Adapting and advocating community responses to regulatory and power concentrations* highlight how public-commons partnerships resist commodification and advocate for systemic reforms. These partnerships expose the limitations of privatized energy systems, presenting compelling cases for regulatory changes that prioritize equity and accessibility. Giotitsas et al., who propose reconfiguring energy systems as a Commons to address the unsustainability of dominant socio-economic structures, support this perspective [5]. Our findings reinforce this view by revealing how deeply embedded power asymmetries constrain the room for manoeuvre available to Energy commons. Rather than operating on a level playing field, these initiatives must remain constantly vigilant to legal frameworks and market dynamics often shaped by the influence of oligopolistic actors. In response, they frequently depend on informal alliances and the strategic use of local government mechanisms to carve out space for alternative governance models.

Collaboration emerges as a critical mechanism for resisting privatization. The theme *Fostering collaboration over competition* underscores how public institutions and Energy commons can align their goals by prioritizing collective benefits over competitive individualism. By fostering trust and aligning diverse actors under a shared vision, public-commons partnerships strengthen their ability to navigate regulatory and market challenges. This aligns with the principles of energy democracy, as conceptualized by Szulecki, which emphasizes decentralization, participatory governance, and social ownership [2]. This

collective ownership in community-based energy initiatives serves as a powerful mechanism to resist privatization and promote equitable, sustainable transitions [37]. A process further strengthened through effective collaboration.

5.5. Strengthening collaborative efforts for systemic transformation

Collaboration is not only a means to resist privatization but also a pathway to systemic transformation. The themes *Building Social Capital through Trust, Conflict, and Shared Vision* and *Fostering Collaboration over Competition* highlight the importance of trust-based networks in aligning stakeholders and enhancing the resilience of public-commons partnerships. These networks reduce fragmentation, mitigate conflicts, and foster unified visions, enabling public institutions and Energy commons to work cohesively. They can also safeguard spaces that facilitate the creation of shared visions, thereby fostering trust [61]. This perspective is further supported by Walker and Devine-Wright, who emphasize the role of empowering communities and promoting equity in renewable energy transitions [62].

This alignment is critical for scaling systemic transformation. The themes *Democratizing energy through local governance* and *Transforming local energy systems through eco-social values* illustrate how collaborative efforts embed eco-social principles into governance frameworks, resisting commodification and promoting equitable access. These transformations demonstrate the feasibility of alternative governance models, encouraging broader adoption by public institutions.

6. Conclusions and policy implications

This study advances a grounded theoretical model to better understand the complex dynamics underpinning successful public-commons partnerships in energy governance. By examining the interplay of localized action, collaborative networks, and systemic reforms, the model highlights how Energy commons and public institutions can co-create equitable, sustainable, and participatory energy systems. These findings offer a robust framework for understanding the potential of public-commons partnerships to address the pressing challenges of energy transition while fostering inclusivity and sufficiency. They provide a comprehensive understanding of the mechanisms that drive effective public-commons partnerships in energy governance, offering novel insights into the interplay between localized action and systemic transformation.

While this study focuses on the Spanish context, it yields transferable insights for broader energy transition efforts. It offers a revealing context due to its decentralized governance structure, strong municipalist movements, and increasing contestation around energy democratization. This setting allows for the identification of transversal mechanisms, such as (1) trust-building strategies based on co-governance and long-term collaboration, (2) mechanisms for inter-institutional alignment, such as mutualized governance platforms and shared planning processes, (3) citizen empowerment through technological literacy and open infrastructures, or (4) networked approaches to scale, which leverage partnerships and reciprocal learning across commons and public actors. These dynamics are not exclusive to the Spanish setting and may be adapted to other governance systems, particularly those seeking to democratize energy transitions through collaborative and inclusive frameworks.

At the same time, some mechanisms are more context-dependent and reflect Spain's political, legal and market structure. These include (1) the decentralized political configuration with strong municipalities nested within autonomous communities; (2) the historical presence of municipalist movements and progressive coalitions at the local level; or (3) the high concentration of market power held by entrenched oligopolistic actors in the energy sector. We acknowledge that replicating such configurations may not be feasible or appropriate in all countries. However, understanding their role in shaping effective public-commons partnerships can offer policy-relevant insights for institutional reform and legal innovation elsewhere. Building upon this contextual framing, the remainder of the conclusion explores the model's central mechanisms and their broader relevance in greater depth. First, the study underscores the primacy of localized action as a foundation for energy governance innovations. Community-specific initiatives, such as *Responsive local action* and *Transforming local energy systems through Eco-Social values*, serve as experimental arenas where diverse governance models are tested. These experiments not only address immediate challenges but also embed principles of sufficiency, equity, and inclusivity into local governance systems. This contribution highlights the role of Energy commons as incubators of alternative models, fostering resilience and adaptability in the face of broader systemic challenges. Localized innovation, even in path-dependent or centralized systems, can open new trajectories for democratic energy governance.

Second, the research emphasizes the role of collaborative networks in scaling local solutions and addressing global challenges. The themes *Reciprocal and Diverse Collaborative Networks for Local and Global Capacity Building* and *Balancing Local and Global Dynamics* illustrate how networks facilitate the transfer of resources, knowledge, capacities and strategies. These networks provide the bidirectional feedback loops essential for polycentric governance systems, where local and global dynamics enrich each other. This mechanism is relevant for multilevel governance architectures beyond Spain—such as those in federal states, transnational municipalities, or European Union-wide programs—where horizontal and vertical integration is key to scaling innovation. It bridges the gap between community-centered approaches and broader policy-making, showing how bottom-up initiatives can inform and reshape top-down regulatory frameworks.

Third, the study highlights the transformative potential of technological empowerment within public-commons partnerships. The theme *Reclaiming Citizen Power in the Face of technological opportunity* underscores how citizen-controlled technologies foster transparency and accountability, creating new avenues for democratic participation in energy governance. This finding reinforces the importance of embedding technological literacy and accessibility into public-commons collaboration to ensure equitable participation across socio-economic divides. An insight especially pertinent for other countries grappling with digital divides or algorithmic opacity in energy infrastructures, offering a citizen-centered countermodel rooted in digital commons and technological literacy which can inform inclusive digitalization strategies in public policy.

Finally, the research delves into the tension between marketization and public governance, emphasizing the ability of public-commons partnerships to resist privatization and advocate for equity-driven reforms. Themes such as *Challenging privatization and marketization* and *Fostering collaboration over competition* demonstrate how trust-based networks align diverse stakeholders, enabling them to collectively challenge commodification and promote governance systems prioritizing public goods. Grounded in institutional hybridization, this resistance model offers valuable lessons for countries where liberalized energy markets dominate and social equity concerns are marginalized.

From a policy perspective, these findings offer actionable insights that extend beyond Spain. Policymakers, Energy commons, and public institutions across different regions can draw upon this study to: (1) Support localized action: policymakers should recognize the value of grassroots experiments and create regulatory environments that support localized energy governance, (2) Facilitate durable and trust-based collaborations: public institutions should invest in mechanisms that formalize collaboration with Energy commons, including conflict-resolution frameworks and resource-sharing agreements, (3) Empower citizens: public-commons partnerships must prioritize technological literacy and equitable access to ensure inclusive participation in energy governance and (4) Design enabling environments that embrace pluralism, sufficiency, and democratic control.

These contributions provide a nuanced understanding of the

Table 3
Intervention areas and prescriptions for Energy commons and public institutions.

Intervention area	Prescriptions for Energy commons	Prescriptions for public administrations
Empowering localized action	Tailor initiatives to address community-specific needs while fostering eco-social principles.	Support grassroots experimentation through grants, subsidies, and flexible regulatory frameworks.
Scaling local solutions to broader change	Build partnerships with other commons to exchange knowledge and scale effective practices.	Facilitate the integration of local solutions into broader strategies, supporting scalability while respecting local diversity.
Leveraging technology for equity	Promote open-source technologies to empower community participation in energy governance.	Invest in digital literacy programs and ensure equitable access to technology across socio-economic groups.
Resisting privatization	Advocate for energy as a public good and actively challenge commodification through collective action.	Implement legal safeguards against privatization and align energy governance with inclusivity principles.
Strengthening collaborative networks	Nurture cross-sector alliances and engage in joint initiatives with public and civil society actors.	Establish platforms and agreements to formalize collaboration, including resource-sharing mechanisms.
Building social capital	Facilitate trust-building activities within communities and between stakeholders.	Design trust-building mechanisms that align diverse actors under shared goals and provide conflict resolution resources.
Systemic transformation	Develop and showcase scalable eco-social models for governance that prioritize equity and sustainability.	Institutionalize support for commons-driven eco-social models as viable alternatives to market-focused energy systems.

dynamics shaping public-commons partnerships, advancing theoretical debates in governance, sustainability, and participatory democracy while offering practical guidance for policymakers and practitioners. Table 3 (below) details actionable insights for both Energy commons and public administrations to strengthen public-commons collaborations, helping translate theoretical insights into practice across diverse contexts.

Overall, this research positions public-commons partnerships as strategic vehicles for reconfiguring energy governance systems beyond national boundaries. It contributes to theoretical discussions on commons governance and public-private partnerships by advancing a dynamic model that bridges localized action and systemic change. The findings underscore the importance of feedback loops and collaborative networks in sustaining public-commons partnerships, aligning with theories of polycentric governance. By demonstrating the transformative potential of eco-social principles, collaborative networks, and citizen empowerment, this research offers a pathway for redefining energy governance to prioritize inclusivity and sustainability. As energy systems worldwide face intersecting crises—from climate disruption to inequality and authoritarian backlashes—the uncovered principles and mechanisms provide a template for democratic, inclusive, and resilient energy transitions.

Future studies should explore how these dynamics unfold across diverse cultural, political, and economic contexts to capture the variability in public-commons partnerships. Examining regions with varying levels of decentralization, regulatory constraints, or technological capacities will provide a more granular understanding of the mechanisms at play. Additionally, the long-term sustainability of public-commons partnerships deserves further investigation. In this regard, the concept of the partner state [63,64] offers a useful framework to explore how public institutions might evolve to co-produce long lasting institutional innovations with commons actors. Jointly, research should assess how these partnerships adapt to evolving challenges, such as political shifts, technological disruptions, or climate-induced pressures, and their ability to maintain inclusivity and equity over time. Finally, comparative analyses across different sectors—such as water management, housing, or digital commons—will show whether the dynamics identified in this study are specific to energy governance or represent broader patterns in public-commons partnerships. Such interdisciplinary inquiry could significantly enhance our understanding of commons governance and its potential to address systemic socio-environmental challenges.

The outputs of this research extend beyond academic discourse. Public-commons partnerships have the potential to reshape energy systems into participatory, equitable, and resilient frameworks. For policymakers, this necessitates a proactive stance in supporting localized initiatives, fostering networks, and safeguarding against commodification. For Energy commons, the findings underscore the need to build trust, leverage technology, and align collective action with systemic reforms. As energy systems worldwide face unprecedented challenges from climate change and inequality, public-commons partnerships offer a critical mechanism for fostering sustainable transitions. By integrating local innovation with global frameworks, empowering citizens through technology, and prioritizing collaboration over competition, these partnerships can pave the way for a more just and sustainable energy future.

CRediT authorship contribution statement

Ekhi Atutxa: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Iñigo Calvo-Sotomayor:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Xabier Mendizabal:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no competing interests.

Acknowledgment

We are deeply grateful to the 18 initiatives that generously shared their experiences and insights during the fieldwork. This research would not have been possible without their engagement and openness.

Annex A

Interview code	Initiative	Description
Self-managed communities for life		
INA1	Arterra Bizimodu	A community that strives to become a reference in the research and education toward sustainable and resilient development models. For more information, visit: https://arterrabizimodu.org
INA2	Cardedeu en Transició	It is based on cooperation and community and its goal is to create an active, committed network in order to achieve a resilient, quality of life as an alternative to the system. For more information, visit: https://cardedeuentransicio.wordpress.com/
INA3	Lakabe	A reference in counter urbanization, rural occupancy, eco-villages, community life and green living. For more information, visit: https://www.lakabe.org/
INA4	Sunseed	A non-profit organisation which develops, demonstrates and disseminates sustainable alternatives. For more information, visit: https://https://www.sunseed.org.uk/
INA5	Transición Rompe el Círculo	It does not only strive to foster a transition like the one taking place in many places around the world, but it also wishes to do so by experimenting with non-capitalist ways of organisation of the economic, social and cultural life. For more information, visit: https://institutodetransicion.rompeelcirculo.org/
INA6	Astra	A self-governed space, which fosters direct citizen and social fabric participation in the management of a public, community-based space. https://astragernika.net/
INA7	Observatorio Crítico de la Energía	A forum to discuss and analyze the unsustainability of our current energy and economic model. For more information, visit: https://observatoriocriticodelaenergia.org/
Renewable energy cooperatives		
CER1	Goiener	An energy generation and consumption cooperative which seeks to achieve energy sovereignty. For more information, visit: https://www.goiener.com/
CER2	Som Energía	A green, non-profit, energy consumption cooperative, committed to fostering the transition of the energy model to 100 % renewable energies. For more information, visit: https://www.somenergia.coop/
CER3	Megara	A 100 % renewable electricity cooperative. It views itself as green, social, local and economical. For more information, visit: https://www.megaraenergia.com/
CER4	Solabria Enerplus	A non-profit cooperative who strives for an energy model that puts people and the planet before financial gains. For more information, visit: http://www.solabria.es/home/
Social enterprises		
ESO1	Ecooo	A non-profit institution which uses profits toward the creation of social fabric, and outreach and awareness campaigns on the transition toward an energy model based on savings, efficiency and renewable energies. For more information, visit: https://ecooo.es/
ESO2	Eolpop	An initiative that aims to install a wind turbine of shared ownership among citizens who voluntarily donate the money required to bring this project to life. This project was the first of its kind in Spain and represents a model of social, political and economic integration. For more information, visit: http://www.viuredelaire.cat/en/what-is-eolpop.html
Municipal initiatives		
IMU1	Barcelona Energía	A public electricity distributor responsible for the integral management of renewable energy generation for the city of Barcelona, including self-sufficiency and the sale of surplus production. It is also involved in the refurbishment of buildings and the reduction of energy poverty. For more information, visit: https://www.barcelonaenergia.cat/en/
IMU2	Rubí Brilla	One of the strategic projects spearheaded by the Townhall of Rubí whose mid-term objective is to ensure the leadership of the project is shared by the different stakeholders who make up the city and who take ownership of the project and are involved in the decision-taking process. For more information, visit: https://www.rubi.cat/es/ayuntamiento/proyectos-estrategicos/rubibrilla
Associations and foundations		
ASO1	Amigos de la Tierra	A non-profit environmental association whose mission is to foster a local and global transition toward a fair, inclusive society respectful of the environment. The association is composed of individuals who defend social and environmental justice. They firmly believe people and the planet need to be at the heart of policies. For more information, visit: https://www.tierra.org//
ASO2	Fundación Desarrollo Sostenible	It sustains that the best way to democratize the Spanish electrical system is by achieving self-sufficiency with a net balance, and subsequently fostering savings, efficiency and the participation of any citizen. It strives for a more prosperous world, with greater human development and where social equality, democratic participation and solidarity prevails among the different nations and territories. For more information, visit: http://www.fundaciondesarrollosostenible.org/
ASO 3	Fundación Renovables	Founded on the principle of creating a broad social base and its primary objective is to raise public awareness about the need to implement and accelerate the energy model transition based on the guiding principles of savings, efficiency and renewable energy. For more information, visit: https://fundacionrenovables.org/

Data availability

The data that support the findings of this study are not publicly available due to confidentiality required by participating initiatives, which shared sensitive information. However, de-identified data excerpts and aggregated insights may be made available from the corresponding author upon reasonable request for academic and research purposes, and in compliance with ethical guidelines.

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