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RESEARCH ARTICLE

REVISED Regulating renewable energy communities: A distributive justice analysis of wind energy in Germany and Spain

[version 2; peer review: 2 approved with reservations, 1 not approved]

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Abstract

Background

Germany and Spain display starkly divergent patterns of community wind project (CWP) development, despite sharing a comparably high wind energy potential. This article argues that regulatory design constitutes a structurally significant and analytically underexplored variable in understanding this divergence—one that is directly policy-actionable in ways that path-dependent sociocultural factors are not.

Methods

Drawing on legal-doctrinal and comparative methodology applied across two institutional scales—Germany and Spain at state level, North Rhine-Westphalia and Galicia at sub-state level—the article analyses four normative dimensions: legal recognition of community actors, territorial planning regimes, financial mechanisms, and administrative procedures, assessing the distributive justice implications within each.

Results

The German regulatory framework exhibits an internally coherent institutional architecture that actively reduces barriers for community actors, whereas the Spanish framework systematically disadvantages community projects relative to corporate developers.

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Any reports and responses or comments on the article can be found at the end of the article.

Conclusion

The article concludes with a seven-point normative blueprint identifying regulatory reforms capable of advancing distributive justice in Spanish wind energy governance.

Keywords
community wind projects; distributive energy justice; comparative energy law; renewable energy communities; Germany; Spain

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REVISED **Amendments from Version 1**

This revised version responds to three peer reviewers whose comments have substantially improved the manuscript.

The most significant change is the introduction of an analytical matrix in Section 3, which makes explicit the regulatory attributes examined, the sources of evidence and the distributive justice dimension assessed within each of the five analytical units. This responds to a request for greater methodological transparency and also prompted us to articulate more clearly an analytical framework that was implicit in the original version but not formally presented.

Section 2 has been revised to distinguish more carefully between the EU Directive legal categories for community energy and the broader concept of community energy projects used in this article, and to clarify how national transposition has produced markedly different regulatory outcomes in Germany and Spain. The operational definition of CWPs has been lightly reformulated for internal consistency.

Throughout the Discussion and Conclusions, causal language has been replaced by more carefully calibrated comparative inference, consistent with the scope of the legal-doctrinal methodology employed. The German and NRW regulatory framework is now presented explicitly as a strong analytical benchmark rather than an optimal model.

Any further responses from the reviewers can be found at the end of the article

1. Introduction

Germany and Spain ranked first and second, respectively, in the European onshore renewable energy capacity league table in 2024, with 178.7 GW and 88.5 GW of installed capacity (IRENA, 2025). Within Spain, Galicia stands out as one of the leading renewable energy territories: wind energy contributed 38.1% of total electricity generation in 2023—the third-highest share among Spanish autonomous communities—and hydropower a further 35%, bringing total renewable generation to 75.3% of the regional electricity mix (Red Eléctrica, 2024). Within Germany, North Rhine-Westphalia (NRW) generated 26.8% of its electricity from renewable sources in 2024, with wind energy accounting for the majority of that share at 53.9%, followed by solar photovoltaic at 24.5% and biogas at 10.8% (IT:NRW, 2025). These figures reflect a shared quantitative leadership in renewable energy deployment. Yet when the ownership structure of those installations is examined, substantial—even antithetical—differences emerge, particularly with regard to the extent of citizen and local community participation.

In Germany, a consolidated tradition of financial participation by citizens and local actors in renewable energy projects—collectively referred to here as community energy projects—has produced a structurally diversified community energy sector. Using a harmonised dataset covering 30 European countries for the period 2010–2021, Schwanitz et al. (2023) identify approximately 5,015 citizen energy initiatives in Germany compared to 358 in Spain—each initiative potentially comprising multiple projects—, and 11,500 projects recorded compared to 370. The wind energy gap is particularly pronounced: 198 German citizen energy initiatives had wind energy activity, compared to just 3 in Spain.

The existing literature identifies a range of contributing factors to this divergence—historical, socioeconomic, cultural, and institutional—and their importance is acknowledged here. Germany's community energy tradition has deep roots in the anti-nuclear movements of the 1970s and 1980s (Bruns & Ohlhorst, 2011), the cooperative banking infrastructure of the Stadtwerke and Landesbanken, and the developmental lending role of the KfW (Kreditanstalt für Wiederaufbau). Spain's trajectory has followed a markedly different path: the liberalisation and privatisation of the electricity sector from 1997 onwards created market conditions that favoured large operators, with five companies currently controlling 85.6% of the free electricity retail market (CNMC, 2024). In Spain, the disappearance of the *cajas de ahorro*—territorially embedded savings banks—following the post-2008 financial crisis further reduced access to local credit (Tostosa Cosme, 2015).

The absence of community energy project development in Spain cannot be attributed to a lack of environmental mobilisation capacity. During the 1970s and 1980s, Galicia was the scene of intense social movements against energy projects imposed by the central administration, including the proposed Regodela-Xove nuclear power plant and numerous conflicts arising from the occupation of river channels by hydroelectric infrastructure (Aldrey & Vázquez, 2024; López and Lanero, 2011). Moreover, in the Basque Country, the Lemoniz nuclear project triggered sustained anti-nuclear mobilisation, first through local and neighbourhood initiatives and later through broader committees. Over time, the conflict moved beyond opposition to the plant itself and helped give shape to a wider ecologist agenda during the 1980s (Serra Riera, 2026). These mobilisations demonstrate an existing capacity for environmental contestation. However, unlike the German case—where the anti-nuclear movement of the same period crystallised into cooperative energy structures and bottom-up renewable initiatives—Spanish environmental conflicts did not produce a stable wave of institutionalised community energy alternatives. The dominant dynamic was reactive (opposition to specific projects)

rather than propositional (promotion of community-owned alternatives) (Aldrey & Vázquez, 2024; López and Lanero, 2011). This distinction reinforces the central argument: the absence of community energy projects in Spain reflects not a lack of social engagement, but a regulatory environment that has not channelled that social drive into community ownership structures.

However, the contribution of regulatory design as a discrete explanatory variable remains comparatively understudied. This analysis does not claim that regulatory frameworks are the sole factor shaping community energy projects development—the socioeconomic and cultural factors noted above are real and consequential. Rather, it argues that regulatory design constitutes an analytically independent and policy-actionable variable: one that has received insufficient systematic attention in the comparative legal literature, and one whose reform holds genuine transformative potential. While sociocultural factors are largely path-dependent and difficult to alter through policy intervention in the short term, regulatory frameworks are directly subject to legislative revision.

Within the broader category of community energy projects, this analysis focuses specifically on Community Wind Projects (CWPs). The central research question is accordingly formulated as follows: to what extent do the regulatory frameworks applicable in Germany and Spain explain the differential development of community wind projects? Three subsidiary questions follow: (i) what socioeconomic and distributive benefits do CWPs generate, and how do they differ from conventional wind farms in terms of governance, rent distribution and territorial embeddedness? (ii) among the multiple explanatory variables, how significant is the normative regime as a determinant of the observed divergence? (iii) what regulatory reforms could realistically promote greater community wind development in Galicia?

The remainder of the analysis proceeds as follows. Section 2 develops the conceptual framework, defining the concept of community wind project and presenting distributive justice as the analytical lens. Section 3 explains the methodology. Section 4 presents the comparative legal analysis, structured around four normative dimensions and applied at two institutional scales. Section 5 discusses the findings and offers policy recommendations. Section 6 concludes.

2. Conceptual framework

2.1 From energy communities to community wind projects

The growing scholarly interest in community energy projects (CEPs) has generated a substantial body of literature examining their principal drivers and barriers (Brummer, 2018; Langer et al., 2017; Rydin et al., 2015; Savaresi, 2019; Seyfang et al., 2013), their effect on social acceptance (Langer et al., 2017; Rydin et al., 2015), their territorial consequences (Berka & Creamer, 2018), the relationships among the actors involved (Creamer et al., 2018), their governance frameworks (Wolsink & Breukers, 2010) and the motivations of communities in relation to project deployment (Rezaei & Dowlatabadi, 2015). Within this field, CWPs have attracted specific attention for their relevance in rural contexts and their redistributive potential (Bauwens et al., 2016; Curtin et al., 2018; Grashof, 2019; Mey & Diesendorf, 2018; Nolden, 2013; Yin, 2012).

The concept of ‘energy community’ functions as an umbrella category encompassing diverse forms of citizen involvement in the energy domain. Although definitions vary across the literature, most converge on the idea that community energy initiatives involve collective ownership, local participation and the pursuit of shared benefits that transcend purely financial returns. An exhaustive review by Bauwens et al. identified 183 different definitions of community energy projects and concluded that two central characteristics appear consistently: a significant degree of local ownership and control, and the existence of collective benefits, including economic, social, environmental and political outcomes (Bauwens et al., 2022). Earlier conceptualisations similarly stress these elements, defining CEPs as initiatives in which citizens collectively participate in energy production, management or governance while retaining significant influence over decision-making processes (Seyfang et al., 2013, Walker & Devine-Wright, 2008) .

The literature highlights two analytically significant dimensions. The first is a *procedural* dimension: the degree to which communities participate in decision-making processes relating to the development and management of energy projects. The second is an *outcomes* dimension: how the costs and benefits associated with energy infrastructure are distributed among participants and across territories (Bauwens et al., 2022; Walker & Devine-Wright, 2008). These dimensions capture both participatory governance structures and the distributive consequences of community energy initiatives—and, as argued below, are directly relevant to the regulatory analysis undertaken here.

A key conceptual distinction in the literature concerns the difference between ‘geographic communities’—residents of a specific territory whose participation is directly linked to their local environment—and ‘communities of interest’—individuals sharing common motivations or objectives who may be geographically dispersed (Walker, 2008).

At the European policy level, the concept of community energy has been institutionalised through recent legislation. Directive 2018/2001 introduced the notion of renewable energy communities, emphasising effective control by local members and prioritising environmental, social or community benefits over purely financial returns (European Parliament, 2018). Directive 2019/944 defined citizen energy communities, opening participation beyond the strictly local sphere (European Parliament, 2019).

These Directives establish conceptual frameworks and binding transposition obligations for Member States, but do not themselves create directly applicable legal categories: the operative legal definitions, rights and constraints are established by national transposition legislation, which varies substantially across Member States.

In Spain, transposition produced a particularly restrictive framework for community wind development. The initial implementing legislation excluded wind energy from the community energy framework altogether, limited collective self-consumption to installations within 2 km of participating members, and capped eligible capacity at levels that rendered community wind projects effectively unviable in practice. Royal Decree-Law 7/2026 has only recently begun to expand this framework—permitting wind energy within the community energy framework for the first time, extending the distance threshold to 5 km and raising the maximum capacity to 5 MW for community energy installations — though implementing regulation remains pending at the time of writing. In Germany, national legislation operationalised the Directive concepts in substantially more enabling terms, building on a pre-existing framework for citizen energy participation that predates the Directives and was not contingent on them.

Although these Directives have reinforced the recognition of collective energy initiatives within the EU regulatory framework, empirical evidence indicates that their implementation has not yet produced a significant expansion of community wind projects—either in Germany or in Spain (Caramizaru & Uihlein, 2020; ECODES, 2026). They seem to have mainly stimulated smaller-scale renewable initiatives, especially solar photovoltaic and collective self-consumption schemes, while having a much more limited impact on wind-based initiatives (Caramizaru & Uihlein, 2020).

Within this broader framework, CWPs are defined as wind energy initiatives of any scale characterised by partial or total ownership by local entities—such as farmers, businesses, cooperatives, local governments, universities or municipal utilities—in the area surrounding the project, with governance structures that prioritise the local distribution of financial and social benefits over purely external capital extraction. From a territorial perspective, CWPs are typically characterised by the presence of local or community investors who hold a significant share of project ownership and participate in the financial benefits derived from wind energy production.

CWPs as defined here are not distinguished by their legal form—they may take the form of a cooperative, association, limited liability company or other structure—but by three substantive characteristics: they focus on wind energy generation; they pursue financial returns at a scale commensurate with the investment required; and they combine those financial objectives with democratic governance and the distribution of economic and social benefits within the local territory. This means that CWPs, as defined here, may qualify as citizen energy communities under Directive 2019/944, which does not require community benefit to take precedence over financial returns. They would not, however, qualify as renewable energy communities under Directive 2018/2001, which requires that environmental, social or community benefit—rather than financial return—constitute the primary purpose of the entity.

In the European context, transnational comparative studies suggest that the defining feature of community projects lies less in technical scale or the technology employed, and more in a collective ownership structure that promotes social engagement beyond large commercial schemes (Becker & Kunze, 2014; Schreuer & Weismeier-Sammer, 2010). From a governance perspective, community projects typically rely on cooperative principles, voluntary citizen participation and collaborative decision mechanisms that reinforce social capital and local engagement (Simcock, 2016; Mey & Diesendorf, 2018; Walker & Devine-Write, 2008).

The substantial reduction in renewable technology costs has further increased the economic viability of community energy initiatives. According to IRENA (2024), the installation costs of solar photovoltaic systems have fallen by approximately 90% since 2010, while onshore wind generation costs have declined by around 70%. These developments have lowered barriers to entry for citizen-led projects and expanded the potential for community participation in renewable energy systems.

Approximately 70% of renewable electricity generation from solar photovoltaic, onshore wind and hydropower in the European Union originates in rural territories. Similar patterns are observed in Germany and Spain, where around 70% and 80% respectively of renewable generation originates in rural areas (Dorati, 2024), This territorial dimension is especially relevant because ownership and governance structures determine not only who participates in decision-making, but also how economic benefits are distributed among territories—the core concern of distributive energy justice.

2.2 Distributive justice as an analytical lens for regulatory assessment

Energy justice has consolidated itself as a key analytical framework for evaluating the social implications of energy transitions. Within this perspective, distributive justice focuses on how costs, risks and benefits associated with energy systems are allocated among different social groups and territories (Jenkins et al., 2016). This dimension is especially relevant in the context of wind development, where rural communities frequently host large infrastructure while receiving limited economic returns.

Several studies have documented how this imbalance can generate local conflicts and undermine the social legitimacy of renewable energy policies. Rural communities often bear the visual, environmental and territorial impacts of wind farms without obtaining a proportional share of the economic returns generated by those installations (Johansen & Emborg, 2018; Zilles & Marg, 2023). These situations can trigger rising social tensions and growing opposition to wind projects (Astola et al., 2022; Schönauer & Glantz, 2023), eroding the legitimacy of energy policies in rural territories (Wüstenhagen et al., 2007).

Energy communities have been identified in the literature as effective instruments of energy justice (Catney et al., 2014; Creamer et al., 2018; Forman, 2017; Goedkoop & Devine-Wright, 2016; McHarg, 2016; Simcock, 2016; van Veelen, 2018). More specifically, CEPs are presented as mechanisms capable of correcting distributive imbalances. By enabling local ownership or financial participation by citizens, CEPs can redistribute a portion of the economic benefits of the energy transition towards host communities. Empirical studies show that projects with local ownership structures tend to achieve higher levels of social acceptance—with increases of between 30% and 50% in rural areas—and reduce conflicts through direct rent distribution (Grashof, 2019; Wolsink, 2007). They can also generate stable income flows through local taxes, lease payments or community investment returns, contributing to the strengthening of rural economies (Copena & Simón, 2018; Kunlere & Shah, 2024; Romero-Lankao et al., 2023).

Distributive outcomes, however, cannot be analysed independently of the procedural dimension of energy justice. As Walker and Devine-Wright (2008) argue, community energy initiatives embody both dimensions simultaneously, raising questions about who participates in energy governance and how benefits and burdens are allocated among participants and territories. Procedural and distributive justice are therefore closely interrelated: more inclusive governance structures tend to facilitate more equitable benefit-sharing arrangements (Goedkoop & Devine-Wright; 2016; Mundaca et al 2018). Jenkins et al. (2016) explain that distributive justice alerts us to *where* injustices emerge, while procedural justice focuses attention on *how* active community participation is maintained. In CWPs, this interdependence materialises through local financial participation, which not only redistributes benefits but reinforces community engagement and the long-term social legitimacy of the project (Langer et al., 2017).

The literature underscores that distributive dynamics are strongly conditioned by institutional and regulatory frameworks. Public policies determine the conditions under which community actors can participate in energy markets, access financing mechanisms and acquire ownership stakes in renewable projects (Del Río & Burguillo, 2008). When regulatory frameworks impose high financial barriers or concentrate ownership opportunities in large energy companies, those companies absorb the majority of the gains, reducing positive community impacts (Delicado et al., 2016). Conversely, policy environments that facilitate cooperative structures, community investment schemes or specific financial instruments can significantly expand opportunities for local participation. Comparative evidence shows that CEPs do not emerge spontaneously but depend on regulatory frameworks that facilitate shared ownership, capital access and legal recognition of community investment (IRENA, 2020).

Distributive justice is operationalised as an evaluative criterion across four regulatory dimensions: (i) whether legal recognition extends to community actors as legitimate subjects within the energy sector; (ii) whether territorial planning allocates capacity or space specifically to community projects; (iii) whether financial and support mechanisms correct the competitive asymmetry between community actors and corporate developers; and (iv) whether administrative procedures impose disproportionate burdens on smaller-scale community projects. This operationalisation allows distributive justice to function not merely as rhetorical framing, but as a concrete analytical instrument capable of generating actionable normative conclusions.

3. Methodology

A comparative approach grounded in legal-doctrinal analysis is adopted, examining the regulatory frameworks that condition the development of CWPs in Germany and Galicia from the perspective of distributive justice. Legal-doctrinal methodology centres on the systematic analysis of legislation and academic doctrine with a view to identifying normative patterns and evaluating their implications for public policy problems. Here, it is applied comparatively to examine how different regulatory systems generate different outcomes in terms of energy benefit distribution and community participation opportunities. The methodological design combines two complementary analytical components. First, a comprehensive review of the scientific and legal literature on community energy projects, energy justice and energy transition governance, conducted through searches in Web of Science and Scopus. Second, a comparative normative analysis of the regulatory regimes applicable in both territories, drawing on primary sources that include EU, national and regional legislation relevant to wind energy regulation and community participation in energy projects.

This study focuses on CWPs for two key reasons. First, wind energy constitutes one of the dominant sources of renewable generation in both Germany and Spain, making it the most consequential arena in which to examine the distributive effects of ownership structure. Second, CWPs present the most demanding regulatory challenge within the CEP category: their capital intensity, grid connection requirements and planning complexity mean that regulatory design bears most directly on their feasibility. The findings drawn from this subset are, however, analytically generalisable to the broader governance of CEPs.

The comparative analysis operates at two complementary and explicitly distinguished institutional scales. The selection of cases reflects both empirical and analytical criteria. At state level, Germany is selected because of its historically diverse and sustained tradition of community energy development, which makes it the most analytically productive European comparator for understanding how regulatory frameworks can enable community wind participation. Spain is selected on the basis of three pre-analytical criteria: it ranks second in Europe by installed wind capacity, making it a quantitatively significant case; it shares with Germany a comparably high wind energy potential, enabling a meaningful like-for-like comparison; and it constitutes the primary professional and research context of the authorship team, providing privileged access to primary legal sources and institutional knowledge. At sub-state level, Galicia is selected for three reasons: it was the first autonomous community to develop specific regulation for wind resource exploitation; it remains one of the territories with the highest installed capacity; and it constitutes the territorial focus of the LIFE EC4RURAL project within which this research is embedded. NRW is selected not as the most representative German Land, but as the most analytically informative: it combines a significant pre-existing tradition of community wind development with the most advanced sub-state regulatory framework in Germany, having enacted the Bürgerenergiegesetz NRW (BürgEnG NRW, 2023), which mandates citizen participation in new wind projects. The comparison therefore examines a particularly enabling regulatory environment against a comparatively constrained one, in order to identify the range of regulatory variation and derive actionable reform lessons. The findings should not be generalised mechanically to Germany or Spain as a whole: other Länder and other autonomous communities may present different regulatory configurations. This limitation is inherent to case study research and does not diminish the analytical contribution of the study. The cases were selected for their analytical informativeness — not as a random or representative sample — and the regulatory instruments examined are drawn from legislation of general application within each system. The study therefore contributes a detailed comparative analysis of two institutionally distinct contexts that illuminates the range of regulatory choices available, with implications for jurisdictions facing similar governance challenges.

Within each of the four normative dimensions analysed in Section 4 (Legal recognition, Territorial Planning Regimes, Financial Mechanisms and Economic Incentives and Administrative Procedures), the discussion begins with an examination of the state-level comparison (Germany/Spain), then the sub-state-level comparison (NRW/Galicia), and finally identifying the distributive justice implications of the differences observed. This structure ensures analytical consistency and avoids the conflation of Spain and Galicia as a single unit of analysis. The analytical framework, constructed inductively from the comparative literature on regulatory barriers to community energy development, is made explicit in Table 1 below.

Table 1. Analytical matrix for the comparative assessment of regulatory frameworks enabling community wind projects.

Dimension	Regulatory attributes examined	Predominant sources of evidence	Distributive justice dimension
Legal recognition	Existence and content of legal categories for community energy actors; associated rights and obligations; differentiation from general market actors; sub-state mandatory participation requirements; depth of EU Directive transposition	EU directives; national, regional and local legislation	Whether legal recognition extends to community actors as legitimate subjects within the energy sector, enabling access to differentiated rights and mechanisms
Territorial planning	Distribution of planning competences across institutional levels; existence of territorial reserves for community projects; municipal planning autonomy; transparency and participation in planning processes	National and sub-state legislation; territorial planning instruments and sectoral plans; case law	Whether territorial planning allocates capacity or space specifically to community projects, or concentrates development opportunities in actors with greater pre-existing financial capacity
Financial mechanisms—Credit availability	Existence of public financial instruments targeting community energy actors; interest rate conditions; coverage of preliminary development costs; risk-reduction mechanisms	National and sub-state programme documents and funding guidelines	Whether financial and support mechanisms correct the competitive asymmetry between community actors and corporate developers in terms of access to capital for project development
Financial mechanisms—Remuneration and auction systems	Feed-in tariff design and size differentiation; transition to competitive auctions; auction conditions for community actors; transposition of Article 4(4) Directive 2018/2001	EU policy frameworks and guidelines; national legislation; regulatory and auction decisions	Whether financial and support mechanisms correct the competitive asymmetry between community actors and corporate developers in terms of access to remuneration and operational revenue
Administrative procedures	Simplification thresholds and exemptions; processing times; institutional support structures for community projects; proportionality of procedural burdens relative to ownership structure and local benefit generation	National and sub-state legislation; case law	Whether administrative procedures impose disproportionate burdens on community wind projects relative to their scale and local benefit generation

Note: In all dimensions, the predominant sources of evidence identified are complemented by academic and grey literature, interpreted critically with attention to the potential interests of issuing organisations.

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The analytical matrix is designed to be replicable beyond the specific cases examined here. A researcher could apply the same four dimensions, the same regulatory attributes and the same distributive justice lens to other territorial contexts where different levels of public intervention in community energy coexist—whether in other European federal or devolved systems, or in unitary states with significant regional regulatory variation—and obtain directly comparable results without redefining the analytical framework.

However, the applicability of the analytical framework to community energy projects beyond the wind sector requires qualification. Some dimensions are potentially applicable to CEPs regardless of technology: the criteria relating to legal recognition of community actors, access to capital for project development, and proportionality of administrative procedures are not wind-specific and could be applied to solar photovoltaic, biomass or other renewable configurations with minimal adaptation. Other dimensions are more closely tied to the specific characteristics of wind energy: territorial allocation, wind permitting procedures, and auction design conditions reflect the capital intensity, grid connection requirements and planning complexity that are particularly acute for wind installations and may operate differently for smaller-scale or less capital-intensive community energy configurations. The analytical framework should therefore be understood as directly applicable to CWPs, and as potentially useful, but requiring adaptation, for community energy projects involving other technologies or scales.

A significant methodological limitation must be acknowledged. Legal-doctrinal analysis describes what the law *provides for*, not necessarily what it *produces* in practice. The relationship between regulatory design and CWP outcomes is mediated by implementation dynamics, enforcement capacity, political will and sociocultural factors that this methodology cannot fully capture. The findings therefore indicate regulatory *potential*—the extent to which frameworks enable or constrain community participation—rather than definitive causal attribution. This limitation reinforces the need for the quantitative and qualitative empirical research identified in the conclusions.

4. Results: a comparative legal analysis

The analysis reveals a substantial difference in the regulatory conditions for CWP development between the two contexts studied. Within each of the four normative dimensions examined, the analysis proceeds at two explicitly distinguished institutional scales—state level (Germany/Spain) and sub-state level (NRW/Galicia)—before identifying the distributive justice implications of the differences observed.

4.1 Legal recognition

The first differentiating factor lies in how each jurisdiction formally recognises community actors within wind energy regulation. Several studies and institutional reports have highlighted that the institutionalisation of community energy figures provides greater legal certainty and facilitates the mobilisation of investment in community projects (European Economic and Social Committee, 2023; Interreg Europe, 2018; Roberts et al., 2014).

In Germany, *citizens' energy companies* (Bürgerenergiegesellschaften) are explicitly recognised in the Renewable Energy Sources Act (EEG 2017, Article 3(15)), which defines them as entities formed by at least ten natural persons in which more than 50% of voting rights must belong to local residents for at least one year, with no single member permitted to hold more than 10% of the votes. This normative recognition creates a specific legal subject with associated rights—particularly differentiated access to support mechanisms—and obligations. Germany's federal structure, grounded in the subsidiarity principle, has been identified as a significant enabling factor: municipal legislative powers and seed financing arrangements create politically and financially favourable environments for community projects (Beermann & Tews, 2017; Dóci & Gotchev, 2016; Schmid et al., 2020). As of 2023, there were 1,038 energy cooperatives in Germany, with 29% active in wind energy and 46% in electricity supply (DGRV, 2024)—evidence of the sustained development enabled by this regulatory architecture.

The depth of Germany's transposition of Directive 2018/2001 relative to Spain is documented in comparative legal analysis. A systematic study of EU clean energy transition implementation across selected Member States confirms that Germany has operationalised the community energy provisions of the Directive—including the Article 4(4) option to exempt low-capacity installations and community projects from competitive auctions—more comprehensively than Spain (Sina, 2024). A review of energy community development in Germany, Spain and Italy reaches similar conclusions, identifying the absence of a dedicated legal category and operational support instruments as the principal barrier to community energy expansion in Spain (Khorrami et al., 2025).

In Spain, the recognition of energy communities occurred more recently and with greater limitations. The Electricity Sector Act (Ley 24/2013 del Sector Eléctrico, LSE) was amended in 2020 to incorporate renewable energy communities as explicit subjects of the electricity sector, without regulating their rights and obligations in substantive terms. It was not

until 2023 (via RDL 5/2023) that both types of collective entities were granted the rights to produce, consume, store, sell and share renewable energy, and to access markets on a non-discriminatory basis. However, none of these provisions has been developed through implementing regulation, which significantly slows their practical deployment. Several authors have attributed the scarcity of productive energy cooperatives in Spain precisely to this combination of regulatory obstacles, the lack of specific support instruments and the absence of a politically enabling environment (Heras-Saizarbitoria et al., 2018; Hewitt et al., 2017, 2019). Most recently, Royal Decree-Law 7/2026 of 20 March 2026 introduced, in its Seventeenth Final Provision, an obligation on the Spanish government to approve—within three months—an implementing regulation for renewable energy communities and citizen energy communities, explicitly providing for the possibility of reserving auction capacity for community and local authority projects. This represents the first time Spain has legally mandated the implementation of the EU community energy framework in operational terms. However, at the time of writing the three-month deadline had not elapsed and the content of the future regulation remains to be determined.

At sub-state level, the contrast intensifies. The NRW Citizens' Energy Act (Bürgerenergiegesetz NRW, BürgEnG NRW 2023) converts local participation from an aspiration into a legal obligation by requiring the economic inclusion of citizens and municipalities in new wind farms developed in the Land. This legislation represents a qualitative shift: it is no longer sufficient for regulatory frameworks to *permit* community participation; the NRW framework *mandates* it, transforming distributive justice from a policy goal into a legally enforceable right.

It should be noted, however, that the BürgEnG NRW mandates economic inclusion — financial participation and benefit-sharing—rather than community ownership in the full proprietary sense. The law requires that citizens and municipalities be offered a stake in the financial returns of new wind projects, but does not require that they hold governance rights commensurate with that stake. The difference is not merely terminological: the NRW framework represents a substantial advance in distributive terms relative to the Spanish and Galician baseline, but it occupies an intermediate position between benefit-sharing and full community ownership on the distributive justice spectrum identified in Section 2.1.

In Galicia, the absence of specific regulation has constrained CWP development. The only partially comparable figure was the Parques Eólicos Singulares (PES—Singular Wind Farms) established under Decree 302/2001 (in force until 2007), which limited installations to a maximum capacity of 3 MW and required direct authorisation from the regional administration. These constraints, combined with the absence of periodic calls, high grid connection costs and lack of specific incentives for local investors, contributed to very limited development. As of May 2025, Galicia had 16 singular wind farms with a total capacity of 40 MW, the majority in municipal public ownership—these 13 municipal wind parks are the only installations considered to be of a community nature in Galicia (INEGA, 2025).

The overall picture at the sub-state level mirrors and amplifies the state-level comparison: while Spain has moved from legal invisibility to partial recognition without operational development, NRW has moved from enabling to mandating.

From a distributive justice perspective, the explicit legal recognition of community actors as differentiated subjects within the regulatory system constitutes the foundational condition for distributive participation. Without this recognition, community actors lack the legal standing to access preferential mechanisms or invoke rights within administrative procedures. The progressive NRW model demonstrates that recognition alone is insufficient: effective distributive impact requires that community participation be a legal obligation, not merely a permitted option.

4.2 Territorial planning regimes

Territorial planning constitutes the second institutional mechanism shaping community participation in wind development. Planning systems that reserve land for local actors tend to expand energy system equity, while centralised planning concentrates development opportunities in actors with greater pre-existing financial capacity.

In Germany, wind energy planning is articulated through a multi-level system combining state development plans, regional development plans and municipal land-use plans (Bebauungspläne) under the Federal Building Code (BauGB, §35). This system prioritises wind farm installation in outlying areas, subject to restrictions established by the Federal Immission Control Act (BImSchG). The BauGB framework endows municipalities with both planning authority and veto capacity over wind development in their territory, enabling them to designate land-use concentration zones and negotiate benefit-sharing arrangements with developers. This ruling confirms that municipalities retain genuine discretionary authority to structure the spatial distribution of wind energy within their territory, including the power to organise development through concentration zones without being bound to include parcels already subject to existing planning instruments. This judicial confirmation of municipal planning autonomy is relevant to CWP development insofar as it

reinforces the legal basis upon which municipalities may shape wind development conditions in ways favourable to local actors—though the ruling itself does not address community energy specifically.

In Spain, wind energy planning competences are constitutionally distributed to the autonomous communities, with the exception of installations exceeding 50 MW, which fall under state jurisdiction. The state has not developed a national territorial planning framework for wind energy, leaving planning entirely to autonomous community legislation. This constitutional division, while formally decentralised, has not in practice produced sub-state planning frameworks that favour community participation—as the Galician case demonstrates.

In Germany, each state must reserve specific areas for wind development within its territory with areas classified as priority, reservation or suitable zones. The WindBG established that NRW must secure 1.8% (61,402 ha) of its territory for wind energy planning by 2032, a target that the region is on track to achieve by 2026 (MWIDE, 2025; WindBG, 2022). Municipalities prepare development plans that must take regional plans into account but may incorporate additional wind energy concentration zones (WWEA, 2016). This planning capacity makes municipalities politically relevant actors within the wind development process, enabling them to reserve specific areas for community projects and secure direct economic returns for the local community (Bruns & Ohlhorst, 2011; Goedkoop & Devine-Wright, 2016).

Galicia adopted a substantially different model. The 1997 Sectoral Wind Energy Plan (Plan Eólico Sectorial) established a system of centralised strategic planning in which the regional administration (Xunta de Galicia) defined priority zones for wind development, with those decisions prevailing over municipal planning instruments. When this Plan was approved, most areas with the greatest wind potential had already been assigned to large private developers through the strategic wind plan approval process (Montero et al., 2010). Developers who obtained approval of their strategic wind plans acquired preferential investigation and administrative authorisation rights, consolidating their control over the wind resource. The planning process was fundamentally top-down, with limited local actor participation and restricted public transparency. No territorial reserves or specific instruments oriented towards facilitating community wind initiatives were contemplated, leaving such projects outside the initial institutional design (Montero et al., 2010).

In distributive justice terms, municipal planning autonomy functions as a direct distributive mechanism. The ability to zone land specifically for community wind development ensures that territorial resources are not exclusively captured by corporate developers in competitive processes where community actors are structurally disadvantaged. In Germany, distributive considerations are embedded into the planning architecture itself; in Galicia, planning created conditions that structurally disadvantage community participation by assigning resources to large developers before communities had the institutional capacity to compete.

4.3 Financial mechanisms and economic incentives

Access to finance constitutes the third pillar conditioning CWP development. Without access to low-cost capital, community projects are economically unviable against corporate developers with access to institutional financing (Bauwens et al., 2016; Curtin et al., 2018; Grashof, 2019).

4.3.1 Credit availability

Germany's KfW (Kreditanstalt für Wiederaufbau) offers loans at preferential interest rates—frequently below 2% (soft loans)—to finance the development and construction of renewable energy projects. These instruments facilitate capital access for small enterprises and energy cooperatives, reducing the financial risk premium that community actors face due to the smaller scale and lower diversification of their project portfolios (Bauwens et al., 2016; Curtin et al., 2018). In 2023, the Federal Ministry for Economic Affairs and Climate Action (BMWK) implemented the 'Community Energy Companies for Onshore Wind' funding guideline, covering up to 70% of planning and permitting costs, with a maximum of €200,000 per project (BMWK, 2022). In 2024, this programme was extended, raising the maximum ceiling to €300,000 per project and relaxing participation requirements (BMWK, 2024).

Spain has no equivalent instruments at state level. The *cajas de ahorro*—savings institutions with strong territorial embeddedness—partially fulfilled a comparable function historically, channelling surpluses towards social purposes and providing accessible local credit. Their effective disappearance from the Spanish financial system following post-2008 restructuring created a financial vacuum with no comparable replacement (Tortosa Cosme, 2015), reducing the availability of long-term, low-cost financing for community initiatives. The ICO (Instituto de Crédito Oficial) has not developed specific credit lines for community wind projects, despite this being recommended by IDAE (Instituto para la Diversificación y Ahorro de la Energía) since 2019.

In NRW, the Bürgerenergiefonds NRW—co-financed by the Land and managed by the public development bank NRW. BANK—covers preparation costs and preliminary studies up to €300,000 and requires repayment only if the project is executed (NRW, 2024) This mechanism significantly reduces the financial risk that local actors face in the early phases of project development—the phase at which community projects are most likely to fail for lack of resources.

In Galicia, no equivalent instruments were developed. Decree 242/2007 attempted to open a pathway for direct participation by permitting developers to offer capital to public entities or affected individuals (Article 9(2)), but changes in regional government prevented its application and the provision was ultimately repealed without having been implemented.

4.3.2 Generation remuneration mechanisms

Germany introduced feed-in tariffs (FITs) through the Electricity Feed-in Act of 1990,[1] subsequently expanded and differentiated by technology and installation size through the EEG 2000. These particularly benefited smaller community wind projects through higher tariffs (Curtin et al., 2018), providing stable revenue streams over 20 years. The EEG 2012 introduced feed-in premiums (initially optional, subsequently mandatory from EEG 2014), based on Contracts for Difference (Curtin et al., 2018; Romero-Rubio & de Andrés Diaz, 2015).[2] Although this transition increased market exposure, the extended period of stable FITs had allowed a substantial base of community projects to become financially consolidated before competitive pressure intensified.

Spain followed an initially similar trajectory under the 1997 Electricity Sector Act, but between 2010 and 2013 reforms to address the 'tariff deficit' suppressed premiums through Ley 24/2013 and Royal Decree 413/2014. Critically—and unlike the German model—this occurred without ever having established size-based differentiation in the remuneration system, generating regulatory instability that had a chilling effect on community wind investment.

4.3.3 Auction systems

From 2014, the European Commission promoted the gradual replacement of direct subsidies by competitive auction systems (Communication 2014/C 200/01), a trend followed by both Germany and Spain. This transition has proven particularly detrimental to CWPs, which must absorb planning and permitting costs prior to the auction that are entirely lost in the event of a failed bid, while large developers can spread these sunk costs across broad project portfolios (Grashof, 2019).

Germany introduced an exemption clause for citizens' energy cooperatives in its 2017 onshore wind auctions. The key advantages for projects limited to six turbines and 18 MW total capacity included: the ability to bid without prior approval under the BImSchG (with the obligation to obtain the permit before construction); a bid bond of €30/kW split into two staged payments of €15/kW; an extended commissioning deadline of 48 months (compared to 30 months for conventional projects); and uniform pricing, meaning cooperatives received the highest winning bid regardless of their own bid, rather than the pay-as-bid system applied to other participants (Lundberg, 2019; Sternkopf, 2016).[3] This exemption clause constitutes a direct legislative response to the asymmetric burden that competitive auctions impose on community actors.

Spain applies uniform requirements without any distinction for community projects: a non-divisible guarantee of €60/kW—effectively double the total German bid bond amount—a 12-month deadline for administrative authorisations, and a general pay-as-clear system (Resolución de 10 de abril de 2017; Orden ETU/315/2017). Although Ley 24/2013, via RDL 23/2020 and RDL 5/2023, formally enables energy communities, their specific auction regulation remains pending.

The limited scope of Spanish experimentation in this area is paradigmatically illustrated by the 2021 auction. In October 2021, a specific reserve of 300 MW was opened for distributed generation projects managed by local authorities, cooperatives or local crowdfunding vehicles (Secretaría de Estado de Energía, 2021). The outcome was a near-total failure: only 5.75 MW of the 300 MW reserve were awarded, and exclusively to solar photovoltaic projects—wind energy produced zero uptake (Dirección General de Política Energética y Minas, 2021). This result reflects not an absence

[1]This Act also obliged utilities to connect new independent energy producers to the grid, guaranteeing network access (Curtin et al., 2018)
[2]Note that exceptions were maintained for projects of low capacity (below 100 kW), which continued to be governed by the FIT system (Romero-Rubio & de Andrés Díaz, 2015)
[3]Note that projects below 750 kW continued to benefit from FIPs under s 22(2) EEG 2017; projects below 100 kW retained FITs under ss 19(1)(2) and 21 EEG 2017 (see Sternkopf, 2016)

of community interest, but the intersection of multiple structural barriers: requirements unadapted to community-scale actors, lack of prior institutional support instruments, and the fundamental competitive disadvantage of community actors in formal competitive processes designed for corporate developers. The 2022 auction reserved a further 140 MW for distributed photovoltaic energy—wind energy had already disappeared from the community reserve altogether (Dirección General de Política Energética y Minas, 2022; MITECO, 2023).

The transposition of Article 4(4) of Directive 2018/2001—which enables Member States to exclude low-capacity installations and community energy projects from competitive tender procedures—provides a particularly sharp illustration of the Germany-Spain divergence. Germany operationalised this provision in the EEG 2023: Section 19 establishes fixed feed-in tariffs for installations below 100 kW, which are excluded from the auction obligation, while Section 34 codifies the exemption for certain categories of small installations from competitive tendering (EEG, 2023). Spain formally acknowledged Article 4(4) in the preamble to Royal Decree 960/2020 on the economic support regime for renewable energy, which states that low-capacity installations and demonstration projects may be excluded from auction procedures. However, this acknowledgment was never translated into operational provision: in the four successive auctions conducted under that Decree, Article 4(4) criteria were not applied (del Río & Kiefer, 2023; Real Decreto 960/2020, 2020). The analytical significance of this non-application is that it was not legally required by EU law—the EU framework explicitly permitted Spain to create a community wind exemption, and Spain chose not to do so. The RDL 7/2026 mandate, if followed by substantive implementing regulation, would represent the first operational deployment of Article 4(4) in Spanish renewable energy law.

A distributive justice analysis indicates that the absence of public financial instruments specifically targeting community actors perpetuates a structural asymmetry that cannot be attributed to market competition but to regulatory design choices. The 2021 Spanish auction failure is particularly instructive: a formal commitment to community participation—300 MW nominally reserved—produced virtually no community wind outcomes because the underlying regulatory architecture remained designed for corporate actors. This indicates that formal commitments to community participation, in the absence od adapted regulatory instruments, may not translate into distributive outcomes.

4.4 Administrative procedures

The simplification of authorisation procedures for renewable energy projects can reduce administrative burdens and processing times. In the majority of jurisdictions, these simplifications are applied as a function of installation size or capacity, without specifically addressing the category of community wind projects. Both Germany and Spain exemplify this generalist approach, albeit with different instruments and thresholds.

In Germany, the Environmental Impact Assessment Act (UVPG, 2025) provided for a simplified screening procedure for wind farms consisting of fewer than twenty turbines exceeding 50 metres in height: shorter deadlines (maximum six weeks) and avoidance of full environmental impact assessment if no significant impacts are anticipated. The Federal Immission Control Act (BImSchG) provides the main authorisation framework at state level, with Länder responsible for administering the procedure.

In Spain, authorisation competences are distributed according to installation capacity: wind farms exceeding 50 MW fall under state jurisdiction, while those below that threshold are the competence of the autonomous communities. Environmental Act 21/2013 provides for a simplified environmental impact assessment procedure for wind farms not exceeding 50 turbines or 30 MW of installed capacity and maintaining a minimum distance of 2 km from other farms (Ley 21/2013, 2013). Unlike the German system, there is no provision for total exemption from authorisation at any scale.

In NRW, simplified procedures apply for wind turbines below 50 metres, including exemption from authorisation for those under 10 metres, which affects primarily small-scale installations (Roberts et al., 2014). More significantly, the procedural framework in NRW operates within a broader policy environment—shaped by the BürgEnG NRW—in which administrative support for community projects is an explicit political priority, reducing de facto procedural complexity through institutional accompaniment.

This predictability reduces transaction costs and litigation risk for all developers operating within the system. While the cases themselves concern commercial projects, the existence of judicially enforceable technical thresholds generates a stable regulatory environment that is structurally more accessible to smaller-scale actors than frameworks characterised by procedural uncertainty—since the cost of absorbing unpredictable litigation outcomes falls disproportionately on actors with limited financial capacity.

In Galicia, the reform of Ley 8/2009 incorporates the category of 'special interest projects', permitting priority and urgent processing of authorisations and reducing instruction phase deadlines by half. However, this declaration is linked to projects promoted by state auction awardees, meaning the abbreviated processing route is associated with large-scale commercial initiatives rather than community projects. The legislation also explicitly excludes experimental wind farms, installations of 100 kW or below, and self-consumption installations without surpluses—none of which generates any regulatory advantage for community wind projects. The net result is a procedural framework that rewards scale and corporate capacity, without any mechanism to reduce disproportionate burdens on community-scale actors.

Administrative simplifications conditioned on large-scale commercial project status effectively invert the principle of proportionality that distributive equity demands. Community projects—which the literature consistently associates with greater local benefits per MW—face comparatively heavier procedural burdens. From a distributive justice perspective, a more oriented regulatory system would condition procedural advantages on ownership structure and local benefit generation, not merely on project size. Overall, the main institutional contrasts identified in the analysis are synthesised in Table 2. The broader pattern that the development of CWPs in Germany is underpinned by institutional coherence among legal recognition, territorial planning, public financing and economic incentives—operating simultaneously at state and sub-state level. In Galicia and Spain, these elements appear weakly articulated or absent at both scales, limiting the emergence of community initiatives. The two-level structure of the comparison reveals an additional finding: the gap between Germany and Spain is amplified at sub-state level, suggesting that regional regulatory autonomy, when exercised proactively, can function as a powerful accelerator—or inhibitor—of CWP development.

5. Discussion and policy recommendations

5.1 Discussion

The results confirm that, beyond the socioeconomic and cultural factors frequently cited in the literature, regulatory design constitutes a structurally significant variable associated with the unequal development of CWPs across the jurisdictions studied. From the perspective of distributive energy justice, regulatory frameworks not only condition the expansion of wind energy but determine who accesses ownership of installations, who captures the rents generated and which actors participate in the governance of these projects.

This research extends a literature that has extensively documented both the sociotechnical barriers and the distributive benefits associated with CWPs (Bauwens et al., 2016; Brummer, 2018; Seyfang et al., 2013), but has devoted comparatively less attention to the specific role of regulatory design in generating or mitigating these dynamics. The comparative analysis suggests that the differences observed—between Germany and Spain at state level, and between NRW and Galicia at sub-state level—are not solely attributable to historical trajectories or sociopolitical contexts, but also to the presence—or absence—of regulatory instruments explicitly oriented towards facilitating community participation.

In Germany, the early institutionalisation of energy communities and citizens' energy companies has fostered local participation through differentiated planning, auction and financing rules. These instruments, operating coherently across state and sub-state levels, significantly reduce the financial and administrative risks associated with wind project development for smaller local actors. The German regulatory framework has provided structural conditions more conducive to correcting distributive imbalances than those prevailing in Spanish frameworks, particularly in rural contexts where local communities historically bore the environmental impacts without receiving proportional benefits (Jenkins et al., 2016).

This dynamic contrasts sharply with the Spanish and Galician case, where wind sector development has occurred primarily through a centralised model favouring developers with pre-existing technical and financial capacity, while social benefits have been largely limited to indirect or marginal compensation (Copena & Simón, 2018). Some authors reinforce this point by noting that, in certain cases, legislation marginalises the place-based cultural values that determine communities' real willingness to accept wind infrastructure (Armeni, 2016), and restricts community participation to technical matters such as noise and visual impact mitigation (Lee and Abbot, 2013).

A further structural factor contributing to this divergence is the asymmetry of technical, economic and legal capacities that local communities face when seeking to promote their own energy projects. In Germany, this asymmetry has been partially mitigated through institutional support: the Windenergieerlasse of the various Länder and local advisory services offer technical guides, standardised contract models and expert support to facilitate community project development (Curtin et al., 2018; Maly, 2014). In Spain, the first relevant state guide for energy communities did not appear until 2019, focused initially on self-consumption projects (IDAE, 2019).

Table 2. Principal institutional characteristics of community wind project development: Germany and North Rhine-Westphalia versus Spain and Galicia.

Institutional dimension	State level: Germany	State level: Spain	Sub-state level: NRW	Sub-state level: Galicia	Distributive justice implications
Legal recognition	Explicit recognition of citizens' energy companies in EEG 2017 (Art 3(15))	Partial recognition in LSE (2020–2023 amendments); no operational implementing regulation	BürgEnG NRW 2023: mandatory citizen and municipal participation in new wind farms	PES (Decree 302/2001, expired 2007); no successor instrument	Germany/NRW: legal certainty enables differentiated rights; Spain/Galicia: recognition without operational effect
Territorial planning	BauGB: multi-level system granting municipalities genuine planning authority and veto capacity	No state planning framework; competence delegated to autonomous communities	1.6% of territory reserved for wind development; municipalities may designate community concentration zones	Centralised Plan Eólico Sectorial (1997): resources pre-assigned to large developers; no municipal capacity	Germany/NRW: municipalities as distributive actors; Galicia: planning forecloses community participation
Public financing	KfW soft loans (<2%); BMWK programme (up to €300 k, 70% of planning costs)	No specific instruments; ICO recommendation unimplemented; cajas de ahorro disappeared	Bürgerenergiefonds NRW (up to €300 k; repayable only if project executed)	No equivalent instruments; Decree 242/2007 repealed without implementation	Germany/NRW: public finance corrects capital access asymmetry; Spain/Galicia: barrier unremedied
Remuneration and auctions	FITs (1990–2014) consolidated CWP base; auction exemption for cooperatives: uniform pricing, staged bond, 48-month deadline	FIT elimination (2013) without size differentiation; uniform auction rules; €60/kW non-divisible bond	—	Specific community reserve (2021) produced 0 MW of wind; wind excluded from 2022 auction	Germany: instruments actively reduce auction asymmetry; Spain/Galicia: formal community reserves produce no community outcomes
Administrative procedures	UVPG simplified screening; no total exemption at state level	Simplified EIA for <50 turbines/<30 MW; no total exemption	Exemption for turbines <10 m; procedural support through BürgEnG NRW ecosystem	Priority processing linked to auction awardees, not community structure; community projects structurally excluded	NRW: procedural environment actively supports community actors; Galicia: procedures reward corporate scale

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International evidence further reinforces the redistributive potential of CWPs. In Fintry (Scotland), a 2 MW turbine generates approximately £500,000 annually reinvested directly in local public services (Munday et al., 2011). Research by Equitable Energy Research shows that local income per MW from community wind farms is 90 to 100 times greater than from conventional farms. In Wiemersdorf (Germany), a nine-turbine community wind farm of approximately 14.4 MW contributes to financing the municipal outdoor swimming pool and provides a 28.5% uplift in local tax revenues (Co2mmunity, 2019). In Denmark, the 40 MW Middelgrunden wind farm is co-owned on an equal basis by a citizen cooperative and a municipal utility, allowing thousands of residents to share in the financial returns (Sørensen et al.,2002). Moreover, as of 2016, around 52% of installed wind capacity in Denmark was owned through citizen ownership models (Gorroño-Albizu et al., 2019). Notably, Phimister and Roberts (2012) have demonstrated through a computable general equilibrium model that, without local ownership, wind farms increase rural GDP but produce virtually no effect on household incomes.

Some emerging initiatives in the Spanish context demonstrate that the CWP model is not inherently unviable under the existing legal architecture. The Viure de l'aire del cel project in Catalonia—the first community wind project in Spain—demonstrates operational viability (Som Energia, 2018; Viure de l'aire del cel, 2018), as do initiatives linked to the University of Vigo (Simón et al., 2026). Several autonomous communities have begun introducing normative reforms: Catalonia has reserved 1.2% of its territory for municipally managed renewable energy projects and established local participation obligations in certain wind and photovoltaic projects Decreto-Ley 24/2021; ICAEN, 2025); the Balearic Islands' Climate Change Act requires that at least 20% of the ownership of renewable projects exceeding 5 MW be offered to local residents or companies (Govern de les Illes Balears, 2022; Ley 10/2019, 2019); and Basque Ley 1/2024, 2024 establishes similar obligations for large-scale wind projects. In Galicia, Recursos de Galicia (RDG) opened 10% of the shareholding of the Mondigo Wind Farm operating company to the three affected municipalities and launched the 'Mondigo Beneficia' programme offering an 80% electricity discount to 500 nearby households (RDG, 2026). These are meaningful steps, but they represent more than a decade of regulatory delay relative to comparable initiatives in Germany, Denmark and Scotland.

The findings align with and extend prior comparative analyses by Romero-Rubio and de Andrés Díaz (2015), situating them within the sequence of subsequent reforms at state level (EEG 2017; RDL 23/2020; RDL 5/2023) and regional level (BürgEnG NRW 2023; Lei 8/2009 in Galicia). They also develop the arguments of Grashof (2019) on the decisive role of regulatory design, suggesting that the absence of differentiated instruments—not merely the presence of formal barriers—is itself a distributive choice whose consequences are analytically traceable, even if their precise magnitude requires further empirical investigation.

The comparative transposition analysis adds a further dimension to this argument that has not previously been systematically explored in the literature. Both Germany and Spain were bound by the same EU Directive provisions regarding community energy, but failed to apply it in four successive auctions pointing out a non-implementation confirmed by empirical research (del Río and Kiefer, 2023). This finding is analytically significant because it indicates that the regulatory deficit is not a matter of legal impossibility within the EU framework: the instruments required for community wind support were available and permitted. The Spanish state's failure to deploy them was a regulatory choice, not a constraint. The RDL 7/2026 mandate for implementing regulation represents a potentially important inflection point, but the track record of Spanish community energy regulation—from legal recognition in 2020 without implementing rules, to the near-total failure of the 2021 community auction reserve—counsels caution about equating legislative commitments with distributive outcomes.

5.2 Policy recommendations

The comparative analysis generates no recommendations for Germany or NRW. This is not an omission, nor does it imply that the German framework constitutes an optimal model -as the limitations documented in Section 5.1 confirm–but an analytical finding: both jurisdictions already incorporate, at state and sub-state level respectively, the principal elements identified as necessary for CWP development—explicit legal recognition with associated rights, municipal planning autonomy, public financial instruments adapted to community-scale actors, differentiated auction rules, and institutional support structures. The German framework's effectiveness derives precisely from the coherent articulation of these elements across institutional scales. The reform agenda, by contrast, lies entirely on the Spanish and Galician side of the comparison.

This said, the German model is not without limitations. The auction exemption introduced in EEG 2017 for citizens' energy companies created an unintended distortion. In the first onshore wind auctions of that year, over 90% of awarded capacity went to bidders formally qualifying as community projects, many of which were later found to be conventional developers exploiting the definitional criteria rather than genuine community actors (Heinrich-Böll-Stiftung Schleswig-Holstein, 2024; Lundberg, 2019). This prompted a reform of the definitional criteria in the EEG 2023, which aligned the

definition of citizen energy companies with the RED II provisions and introduced an exemption from competitive bidding for onshore wind projects up to 18 MW (Heinrich-Böll-Stiftung Schleswig-Holstein, 2024). Above that threshold, community actors re-enter the general auction system, where the structural asymmetries the exemption was designed to correct remain intact. Finally, despite record licensing figures in 2024, Germany's installed capacity of roughly 63 GW fell short of the 69 GW intermediary target set by the EEG for that year, with slow implementation, lengthy permitting procedures averaging four to five years, and insufficient grid infrastructure identified as the principal causes (Clean Energy Wire, 2025). These limitations do not undermine the analytical finding. The German framework remains substantially more enabling for CWPs than its Spanish counterpart, but this also suggests caution against uncritical transposition and underlines the need to adapt instruments to specific territorial contexts.

The principal normative lesson drawn from this analysis is that distributive justice in wind energy is not achieved solely through compensatory mechanisms for territorial impacts, but by enabling local communities to access ownership positions and capture value. The following recommendations are structured at two institutional levels, reflecting the constitutional distribution of competences between the Spanish state and the autonomous communities.

At state level, three reforms are required. The most urgent is the development of implementing regulation for energy communities, including specific provisions for community wind projects. The legal recognition introduced by the LSE (as amended in 2020 and 2023) remains inoperative without implementing regulation. Royal Decree-Law 7/2026 creates an immediate legislative window: its Seventeenth Final Provision legally mandates the approval of such regulation within three months, with explicit provision for auction capacity reserves for community and local authority projects. This window should be used to create a regulatory framework that defines the legal category of community wind project—analogous to the Bürgerenergiegesellschaft in EEG 2017 and operationalising the Article 4(4) option of Directive 2018/2001—specifying minimum local ownership thresholds, democratic governance requirements and the differentiated rights associated with this status.

Alongside this, auction rules must be adapted to reduce the structural competitive disadvantage faced by community wind projects. As the competent authority for renewable energy auctions and the REER (régimen económico de energías renovables), the Spanish state must introduce differentiated conditions for community wind projects participating in competitive tenders: staged bid bonds equivalent to or below the German model (€15 + 15/kW rather than €60/kW non-divisible), extended commissioning deadlines, and uniform pricing mechanisms. Alternatively, Article 4(4) of Directive 2018/2001 provides an explicit legal basis for excluding community projects of low capacity from the general auction system and applying feed-in tariffs or premiums directly.

Finally, The Instituto de Crédito Oficial has the institutional capacity to deploy soft loan instruments for community energy on the model of KfW, as recommended by IDAE since 2019 but not yet implemented. Terms should include below-market interest rates, repayment periods adapted to community project timescales, and coverage of preliminary development costs on a repayable-only-if-executed basis.

At sub-state level, four complementary reforms are proposed for the Galician autonomous government. Within its competences in territorial planning and wind energy authorisation, the Xunta de Galicia should develop a regulatory instrument—equivalent in ambition to the BürgEnG NRW—that creates a specific legal and procedural pathway for community wind projects, establishes targets for community wind capacity as a percentage of total new capacity authorised, and reserves specific areas in territorial planning instruments for community-promoted projects.

That regulatory framework should be accompanied by mandatory minimum local participation requirements in new wind projects, following the models of the Balearic Islands (20% minimum), the Basque Country and NRW (mandatory citizen and municipal inclusion), the Xunta de Galicia should require developers seeking wind energy authorisation to offer a minimum percentage of project ownership to residents of or municipalities hosting the installation. The Mondigo case demonstrates that this model is politically viable within the Galician institutional context.

To address the financing gap that prevents community projects from reaching the authorisation stage, a Galician community energy fund should be established, Modelled on the Bürgerenergiefonds NRW and managed through a public financial institution such as the Instituto Galego de Promoción Económica (IGAPE), this fund should cover preliminary project development costs—resource assessment, legal structuring, grid connection studies, administrative fees—on a repayable-only-if-executed basis, removing the most significant financial barrier at the stage where community projects are most likely to fail.

Finally, the INEGA's mandate should be expanded to include active promotion and expert accompaniment of community wind projects across all development phases. Drawing on the model of the German Windenergieerlasse—technical guides, standardised contractual models, expert advisory networks—this support would reduce the information asymmetry between community actors and corporate developers.

The seven recommendations together constitute a coherent normative package distributed across two institutional levels. Their effectiveness depends on coordinated deployment: state-level instruments without sub-state implementation capacity, or sub-state ambition without state-level auction reform, will reproduce the pattern already observed in 2021—formal community provisions that produce no community outcomes.

6. Conclusions

The analysis demonstrates that, despite a comparably high wind energy potential, the penetration of community wind projects is substantially greater in Germany than in Spain. The comparative legal analysis suggests that this divergence is not adequately accounted for by socioeconomic or cultural factors alone, and that the regulatory architecture constitutes a significant and analytically independent variable in understanding it, examined at both state and sub-state level through the lens of distributive justice.

The contribution of this study is articulated at two complementary levels. At the *analytical* level, it demonstrates, through legal-doctrinal and comparative methodology, that the unequal trajectory between Germany and Galicia is linked to: (a) effective legal recognition of community actors as differentiated regulatory subjects, operating as a precondition for all other mechanisms; (b) a territorial planning system that grants municipalities genuine capacity to influence and negotiate wind development decisions; and (c) the existence of financing and risk-reduction instruments—soft credit, technical guidance and adapted auction rules—that correct the asymmetries between corporate developers and rural communities. The two-level analytical structure shows that these elements are more effective when they function coherently across institutional scales: the German federal architecture multiplies their effect, while the fragmented Spanish regulatory landscape dilutes it.

At the *normative-applied* level, these findings are translated into a seven-point regulatory blueprint distributed across two institutional levels—three recommendations directed at the Spanish state (implementing regulation for energy communities, auction reform, ICO credit lines) and four directed at the Galician autonomous government (specific CWP regulatory framework with targets, mandatory minimum local participation, Galician community energy fund, institutional support structures). This two-level structure is analytically grounded: the German evidence indicates that state-level instruments and sub-state implementation are more effective when deployed coherently, and the absence of their appears associated with limited produces community outcomes in practice. Equally, no recommendations are formulated for Germany or NRW—this is a finding, not an omission. Both jurisdictions already incorporate the elements identified as necessary, and the reform agenda lies entirely on the Spanish and Galician side of the comparison.

The study also recognises the limitations inherent in a primarily legal-doctrinal approach. This methodology accurately describes what regulatory frameworks provide for but cannot fully capture the mediating role of implementation dynamics, political will or sociocultural factors in translating regulatory provisions into development outcomes. Future research could extend this analysis to other renewable technologies, particularly solar photovoltaic, in order to assess whether the regulatory patterns and distributive dynamics identified for wind energy are transferable to different sociotechnical contexts. It should also address longitudinal evaluations of distributive justice outcomes under different regulatory regimes; comparative analysis of the sociopolitical dynamics—community perceptions, cultural barriers, organisational capacities—that mediate between regulatory design and CWP deployment; and assessment of the Mondigo case and other emerging Spanish initiatives as natural experiments for evaluating the distributive effects of partial ownership opening. In this way, distributive justice can be operationalised not merely as a declarative principle in energy law, but as an evaluative standard for assesing regulatory performance in rural energy transitions. These might include the share of locally owned installed capacity, the proportion of wind energy rents retained within host territories, the degree of community participation in project governance, and the accessibility of ownership and investment opportunities to local actors—areas whose further development remains an important direction for future research.

Ethics and consent

Ethical approval and consent were not required.

Data availability

No new data were created or analysed in this study; data sharing is not applicable to this article.

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Jamie Jenkins
[1] University of Helsinki, Helsinki, Finland
[2] University of Helsinki, Helsinki, Finland

Dear editor & authors,

Firstly, thank you for the invitation to review this paper. It was an interesting and informative read and the research is timely and important. This paper seeks to understand the regulatory differences between two regions in Germany & Spain for developing energy communities. The regulatory environments are analysed through comparative policy and legal analysis using a theoretical framework built from four normative dimensions. I note that you highlight the other potentially contributing factors (socioeconomic and cultural factors) and how your research fills the research gap by looking specifically at regulatory constraints.

The results and policy recommendations are sound and seem logical based on the analysis. I have several comments that might help to strengthen the manuscript, but I believe that the paper is nearly ready to be indexed. My main concern is in the method section as I would suggest you expand upon the process of analysis as it is currently unclear what exactly your process was, what tools were used and what material was studied.

I will include comments below for your consideration:

1. The introduction section feels quite distinct (in terms of voice and style) from the remainder of the paper. The writing is less fluid and hard to read in places. For example, the first paragraph is somewhat confusing to read as it's lists of numbers within numbers. I mostly understand what you're trying to say, but it could be reworded to be clearer.
2. The first sentence of the third paragraph "the existing literature identifies a range of contributing factors…" – contributing factors to what exactly? Renewable energy deployment or EC development? The remainder of this paragraph is also a bit unclear why it's relevant without fully understanding what the topic is in relation to.
3. I note that there is a detailed explanation of ECs in the conceptual framework section, but I would suggest a few explanatory words also in the intro section to describe what you mean

by EC. It would make parts of the intro section become clearer for those who don't fully understand the different types of ECs
4. The conceptual framework section is clear and informative. Relevant literature is used to describe the concepts and theoretical framework. I would suggest making it clearer where the four dimensions for your framework originate – is it based on existing literature, or did you build the framework based on different sources? An explanatory sentence would help.
5. The explanation of why the two case studies was selected is clear and the limitations of the method are presented, however, there is little explanation of the actual process of analysis – what was studied (policy texts, literature sources, grey literature etc.), how was the analysis conducted (inductive or deductive, how exactly was the theoretical framework applied, what tools were used etc.) and how were the results obtained?
6. In addition, the method section mentions a systematic literature review but there is very little explanation of how this was conducted in practice and what part of the results came from the review vs the comparative analysis.

Is the work clearly and accurately presented and does it engage with the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
No

Are all the source data and materials underlying the results available?
No

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Environmental policy (marine and energy), futures methods, stakeholder engagement

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 13 Sep 2026

Xavier Simon

Dear Jamie Jenkins, We thank you for a careful and constructive reading of our manuscript,

and for the positive assessment of the research design, results and policy recommendations. We address each of your comments in turn.

Comment 1: "The introduction section feels quite distinct (in terms of voice and style) from the remainder of the paper. The writing is less fluid and hard to read in places. For example, the first paragraph is somewhat confusing to read as it's lists of numbers within numbers."

Authors' response: We accept this observation. The opening paragraph of the Introduction has been reformulated to improve readability. The revised version maintains all the statistical data — which contextualizes the four territories at both absolute and relative levels — but redistributes the information across clearer sentence structures, eliminating nested parentheses and improving narrative flow. The revised paragraph reads as follows: Germany and Spain ranked first and second, respectively, in the European onshore renewable energy capacity league table in 2024, with 178.7 GW and 88.5 GW of installed capacity (IRENA, 2025). Within Spain, Galicia stands out as one of the leading renewable energy territories: wind energy contributed 38.1% of total electricity generation in 2023 — the third-highest share among Spanish autonomous communities — and hydropower a further 35%, bringing total renewable generation to 75.3% of the regional electricity mix (Red Eléctrica, 2024). Within Germany, North Rhine-Westphalia (NRW) generated 26.8% of its electricity from renewable sources in 2024, with wind energy accounting for the majority of that share at 53.9%, followed by solar photovoltaic at 24.5% and biogas at 10.8% (IT:NRW, 2025).

Comment 2: "The first sentence of the third paragraph 'the existing literature identifies a range of contributing factors...' – contributing factors to what exactly?"

Authors' response: We accept this observation. "To this divergence" has been added to the sentence, making explicit that the contributing factors refer to the divergence in community energy project development between Germany and Spain documented in the preceding paragraphs. The revised sentence reads: "The existing literature identifies a range of contributing factors to this divergence---historical, socioeconomic, cultural, and institutional---and their importance is acknowledged here."

Comment 3: "I would suggest a few explanatory words also in the intro section to describe what you mean by EC."

Authors' response: We accept this suggestion. A brief clarificatory phrase has been introduced in the second paragraph of the Introduction, at the point where community energy projects are first mentioned substantively. The revised sentence reads: "In Germany, a consolidated tradition of financial participation by citizens and local actors in renewable energy projects — collectively referred to here as community energy projects — has produced a structurally diversified sector." This provides the reader with a minimal conceptual anchor without anticipating the full definition developed in Section 2.1.

Comment 4: "I would suggest making it clearer where the four dimensions for your framework originate – is it based on existing literature, or did you build the framework

based on different sources?"

Authors' response: We accept this observation. A explanatory phrase has been added in Section 3, in the sentence that introduces the analytical matrix: "The analytical framework — constructed inductively from the comparative literature on regulatory barriers to community energy development — is made explicit in Table X below." This makes clear that the four dimensions represent an original analytical contribution developed through our review of the comparative literature, rather than being adopted directly from any single existing framework.

Comment 5: "there is little explanation of the actual process of analysis – what was studied, how was the analysis conducted, how exactly was the theoretical framework applied, what tools were used etc."

Authors' response: We accept this observation. The analytical matrix introduced in Section 3 responds directly to this demand, making explicit for each dimension the regulatory attributes examined, the predominant sources of evidence and the corresponding distributive justice dimension applied. Regarding the analytical logic: the four dimensions were constructed inductively from the comparative literature, as noted in response to Comment 4 above; their subsequent application to the four jurisdictions follows a deductive logic, systematically documented in Section 4. No software tools were employed. The results of this application are synthesized in Table 1. No additional changes to the text were required beyond those already described.

Comment 6: "the method section mentions a systematic literature review but there is very little explanation of how this was conducted in practice and what part of the results came from the review vs the comparative analysis."

Authors' response: We accept this observation. Two changes have been introduced. First, the description of the literature review has been revised from "systematic" to "comprehensive" — a more accurate description of the process followed, which was extensive and rigorous but did not employ a formal protocol with pre-defined search strings, inclusion/exclusion criteria and screening procedures. Second, the analytical matrix introduced in Section 3 clarifies, for each dimension, the predominant sources of evidence mobilized — distinguishing between primary legislation at different institutional levels, implementation policies, strategic planning documents, and secondary and grey literature — making transparent which types of sources inform which parts of the comparative analysis. We thank you for the constructive spirit of this review and for the positive assessment of the study's contribution. We remain available to address any further questions. Best regards, Xavier Simón

Competing Interests: No competing interests were disclosed.

Author Response 17 Sep 2026

Xavier Simon

Dear Jamie Jenkins, We thank you for a careful and constructive reading of our manuscript, and for the positive assessment of the research design, results and policy recommendations. We address each of your comments in turn.

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constructed inductively from the comparative literature on regulatory barriers to community energy development — is made explicit in Table X below." This makes clear that the four dimensions represent an original analytical contribution developed through our review of the comparative literature, rather than being adopted directly from any single existing framework.

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Authors' response: We accept this observation. The analytical matrix introduced in Section 3 responds directly to this demand, making explicit for each dimension the regulatory attributes examined, the predominant sources of evidence and the corresponding distributive justice dimension applied. Regarding the analytical logic: the four dimensions were constructed inductively from the comparative literature, as noted in response to Comment 4 above; their subsequent application to the four jurisdictions follows a deductive logic, systematically documented in Section 4. No software tools were employed. The results of this application are synthesized in Table 1. No additional changes to the text were required beyond those already described.

Comment 6: "the method section mentions a systematic literature review but there is very little explanation of how this was conducted in practice and what part of the results came from the review vs the comparative analysis."
Authors' response: We accept this observation. Two changes have been introduced. First, the description of the literature review has been revised from "systematic" to "comprehensive" — a more accurate description of the process followed, which was extensive and rigorous but did not employ a formal protocol with pre-defined search strings, inclusion/exclusion criteria and screening procedures. Second, the analytical matrix introduced in Section 3 clarifies, for each dimension, the predominant sources of evidence mobilized — distinguishing between primary legislation at different institutional levels, implementation policies, strategic planning documents, and secondary and grey literature — making transparent which types of sources inform which parts of the comparative analysis. We thank you for the constructive spirit of this review and for the positive assessment of the study's contribution. We remain available to address any further questions. Best regards, Xavier Simón

Competing Interests: No competing interests were disclosed.

Reviewer Report 02 September 2026

https://doi.org/10.21956/openreseurope.26354.r79088

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Andre Pacheco
[1] Universidade do Algarve, Faro, Portugal
[2] Universidade do Algarve, Faro, Portugal

This manuscript addresses a timely and relevant question: how regulatory design may enable or constrain the development of Community Wind Projects (CWPs), using Germany/Spain and North Rhine-Westphalia (NRW)/Galicia as comparisons at two institutional levels. The paper is clearly written, engages with a substantial and current body of literature, and provides an interesting analysis of legal recognition, territorial planning, financial mechanisms and administrative procedures through the lens of distributive justice.

I particularly value the two-level comparative perspective and the attention given to specific regulatory mechanisms rather than treating the development of renewable energy communities as primarily a socioeconomic or cultural phenomenon. The contrast between the relatively mature institutional framework for citizen energy in Germany/NRW and the still-developing framework in Spain/Galicia provides useful material for policy discussion.

I nevertheless consider that two issues should be addressed to strengthen the scientific robustness of the manuscript.

The first is the Operationalisation and replicability of the comparative framework. The four analytical dimensions provide a clear structure for the study. However, the specific criteria through which these dimensions are assessed become apparent mainly in the Results rather than being explicitly defined in the Methodology. For example, financial mechanisms are subsequently analysed through credit availability, remuneration mechanisms and auction design, while administrative procedures include thresholds, exemptions, processing times and institutional support.

These are relevant criteria, but the methodological framework should make clearer how they were selected and systematically applied. A useful test is whether another researcher could take the methodology as currently described and apply it, without redefining the analytical criteria, to another German Land and another Spanish Autonomous Community and obtain directly comparable results.

I suggest adding a concise analytical matrix identifying, for each of the four dimensions: (i) the regulatory attributes examined; (ii) the evidence used to assess them; and (iii) the corresponding distributive-justice question. No quantitative scoring system is required. This would make explicit the analytical procedure that is already largely implicit in the Results and would substantially improve transparency and replicability.

This clarification would also help qualify the claim that findings from CWPs are generalisable to the broader governance of RECs. Some of the criteria examined e.g., territorial allocation, wind permitting, auction design and high development costs, are particularly relevant to wind projects and may operate differently for other REC configurations. The authors should distinguish between findings that are potentially transferable across RECs and those that are technology- or scale-specific.

The second pint relates with the consistency between methodology, results and

interpretation. The Methodology appropriately acknowledges an important limitation: legal-doctrinal analysis establishes what regulatory frameworks provide for and their potential to enable or constrain community participation, rather than demonstrating what those frameworks produce in practice. I consider this distinction important and encourage the authors to apply it more consistently in the Discussion and Conclusions.

Several statements move from identifying regulatory differences to stronger causal or outcome-based interpretations. For example, that regulatory design explains differences in CWP development, has corrected distributive imbalances, or produces measurable distributive consequences. The comparative evidence convincingly supports the conclusion that Germany/NRW provides a substantially more enabling regulatory environment for CWPs than Spain/Galicia. However, establishing the magnitude of the causal contribution of regulation to observed community-energy outcomes would require additional empirical evidence.
The same caution applies to the conclusion that neither state-level instruments without sub-state implementation nor sub-state ambition without state-level reform can produce community outcomes. The comparison strongly suggests that regulatory coherence across institutional levels is important, but the study design does not independently test these different configurations. I therefore recommend reframing such statements as comparative inferences rather than demonstrated causal relationships. Finally, I would also reconsider presenting Germany/NRW as a regulatory endpoint for which “no recommendations” are required. The manuscript itself identifies limitations of the German system, including unintended effects of auction exemptions, permitting delays and infrastructure constraints. These experiences are particularly valuable precisely because community-energy regulation is an evolving process in which instruments are implemented, evaluated and adjusted. Germany/NRW can therefore provide a strong benchmark and valuable regulatory lessons without being presented as an optimal or completed model.

Relatedly, the manuscript concludes by proposing distributive justice as a “measurable and enforceable standard”. This is an interesting direction that could be developed further. Even without adding a quantitative assessment to the present study, the authors could briefly identify the types of indicators through which regulatory effectiveness and distributive outcomes might subsequently be evaluated e.g.,community/local ownership, community-owned capacity, local value retention, local employment, accessibility of participation, inclusion of vulnerable households, or relevant environmental and social indicators. This would provide a clearer conceptual pathway from regulatory design to community participation using observable outcomes of distributive justice.

Some minor points. The opening sentence of the Methodology refers to the comparison of “Germany and Galicia”. Given the two-level design subsequently described, this should presumably refer to Germany and Spain at state level and NRW and Galicia at sub-state level.

The justification for describing NRW as a regulatory “ceiling” and Galicia as a regulatory “baseline” could also be more carefully formulated. Unless all German Länder and Spanish Autonomous Communities have been systematically assessed, the related expression “maximum normative distance” appears stronger than the comparative evidence can establish.

Finally, the statement that the findings from CWPs are analytically generalisable to RECs more broadly should be reconciled with the Conclusion, which appropriately calls for future research to determine whether the patterns identified for wind are transferable to other technologies such as

solar PV.

Overall, I find the manuscript relevant, informative and potentially valuable for both the energy-community and energy-justice literature. The comparative regulatory analysis contains useful insights, and the concerns above do not require a fundamental redesign of the study. However, I consider the explicit operationalisation of the analytical framework and closer alignment between the methodological scope and the strength of the conclusions necessary to make the analysis scientifically robust.

Is the work clearly and accurately presented and does it engage with the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

Are all the source data and materials underlying the results available?
No source data required

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Renewable energy communities; community energy systems; energy transition and sustainability; renewable energy integration; energy justice and community participation; marine renewable energy; sustainable island communities.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 03 Sep 2026

Xavier Simon

Mr. Andre Pacheco, Thank you for the review and for the excellent comments you made about our work. We are beginning to analyze each of them to incorporate them or to justify our way of proceeding. With all this, the quality of our work will improve and may contribute in some way to expanding knowledge about the role of public policies in the community energy transition. Thank you very much once again for your inspiring comments. Best regards

Competing Interests: No competing interests were disclosed.

Author Response 13 Sep 2026

Xavier Simon

Dear Andre Pacheco, We thank you for a thorough, constructive and generous assessment. Your comments have led to substantive improvements in the operationalization of the analytical framework, the consistency between methodological scope and interpretive claims, and the conceptual precision of the study. We address each point in turn.

Comment 1: "The first is the Operationalization and replicability of the comparative framework. The four analytical dimensions provide a clear structure for the study. However, the specific criteria through which these dimensions are assessed become apparent mainly in the Results rather than being explicitly defined in the Methodology. [...] I suggest adding a concise analytical matrix identifying, for each of the four dimensions: (i) the regulatory attributes examined; (ii) the evidence used to assess them; and (iii) the corresponding distributive-justice question."

Authors' response: We would like to express our particular appreciation for this comment, which we consider one of the most productive suggestions received across all reviews. The analytical matrix was implicit in our work from the outset — as the structure of Section 4 demonstrates — but your observation prompted us to make it explicit, and in doing so, helped us recognize and articulate the methodological coherence of our approach more clearly than the original manuscript achieved. We accept this suggestion and have introduced an analytical matrix in Section 3 (Table 1). The matrix identifies, for each of the five analytical units examined — legal recognition, territorial planning, financial mechanisms for project development, financial mechanisms for operational revenue, and administrative procedures — the regulatory attributes examined, the predominant sources of evidence mobilized at each institutional level, and the corresponding distributive justice dimension as operationalized in Section 2.2. Regarding sources of evidence, the matrix reflects the different institutional levels relevant to each dimension, ranging from EU directives and national legislation in legal recognition and financial mechanisms, to national and sub-state legislation and case law in territorial planning and administrative procedures. In all dimensions, these predominant sources are complemented by academic and grey literature, interpreted critically with attention to the potential interests of issuing organizations. Regarding the distributive justice dimension, the matrix connects each analytical dimension directly to the four criteria operationalized in Section 2.2, without introducing new criteria. The matrix is followed by two new paragraphs addressing replicability and transferability, discussed further in our response to Comment 2 below.

Comment 2: "This clarification would also help qualify the claim that findings from CWPs are generalisable to the broader governance of RECs. Some of the criteria examined e.g., territorial allocation, wind permitting, auction design and high development costs, are particularly relevant to wind projects and may operate differently for other REC configurations. The authors should distinguish between findings that are potentially

transferable across RECs and those that are technology- or scale-specific."

Authors' response: We accept this qualification. The two paragraphs that follow the matrix in Section 3. The first paragraph clarifies that the analytical matrix is designed to be replicable beyond the specific cases examined: a researcher could apply the same dimensions, regulatory attributes and distributive justice dimensions to other territorial contexts where different levels of public intervention in community energy coexist — in other European federal or devolved systems, or in unitary states with significant regional regulatory variation — without redefining the analytical framework. The second paragraph introduces the qualification the reviewer requests. Some dimensions are potentially applicable to CEPs regardless of technology: legal recognition of community actors, access to capital for project development, and proportionality of administrative procedures are not wind-specific and could be applied to solar photovoltaic, biomass or other renewable configurations with minimal adaptation. Other dimensions are more closely tied to the specific characteristics of wind energy: territorial allocation, wind permitting procedures, and auction design conditions reflect the capital intensity, grid connection requirements and planning complexity particularly acute for wind installations and may operate differently for smaller-scale or less capital-intensive community energy configurations. The analytical framework should therefore be understood as directly applicable to CWPs, and as potentially useful — but requiring adaptation — for community energy projects involving other technologies or scales.

Comment 3: "The Methodology appropriately acknowledges an important limitation: legal-doctrinal analysis establishes what regulatory frameworks provide for and their potential to enable or constrain community participation, rather than demonstrating what those frameworks produce in practice. I consider this distinction important and encourage the authors to apply it more consistently in the Discussion and Conclusions. Several statements move from identifying regulatory differences to stronger causal or outcome-based interpretations."

Authors' response: We accept this criticism fully, and consider that addressing it has substantially strengthened the analytical coherence of the manuscript. Sections 1, 4, 5 and 6 have been reviewed in full to identify and reformulate all statements that moved from identifying regulatory differences to stronger causal or outcome-based interpretations. Specifically, the following reformulations have been introduced throughout the text to ensure consistency between the methodological scope of the study and the strength of the interpretive claims:

- "explaining this divergence" in the Abstract was replaced by "understanding this divergence", ensuring consistency with the methodological scope of the study as reflected in the reformulations introduced throughout the text.
- "regulatory design plays a structurally significant role in explaining" was replaced by "regulatory design constitutes a structurally significant variable associated with".
- "The German regulatory framework has thus functioned as a mechanism for correcting distributive imbalances" was replaced by "The German regulatory framework has provided structural conditions more conducive to correcting distributive imbalances than the Spanish framework, particularly in rural contexts

where local communities historically bore the environmental impacts without receiving proportional benefits".
- "demonstrating that the absence of differentiated instruments is itself a distributive choice with measurable consequences" was substituted by "indicating that the absence of differentiated instruments constitutes a distributive choice whose consequences are analytically traceable, even if their precise magnitude requires further empirical investigation".
- "demonstrates that the regulatory deficit is not a matter of legal impossibility" was reworded as "shows that the regulatory deficit is not a matter of legal impossibility".
- "reveals that this divergence cannot be explained solely by socioeconomic or cultural factors but is significantly shaped by the regulatory architecture" was reformulated as "indicates that this divergence is not adequately accounted for by socioeconomic or cultural factors alone, and that regulatory architecture constitutes a significant and analytically independent variable in understanding it".
- "reveals that these elements must function coherently across institutional scales" was rephrased as "suggests that these elements are more effective when they function coherently across institutional scales".
- "demonstrates that neither state-level instruments without sub-state implementation, nor sub-state ambition without state-level auction reform, produces community outcomes in practice" was recast as "shows that the absence of either appears associated with limited community outcomes in practice".
- "measurable and enforceable standard for evaluating regulatory performance" was replaced by "evaluative standard for assessing regulatory performance in rural energy transitions. These might include the share of locally owned installed capacity, the proportion of wind energy rents retained within host territories, the degree of community participation in project governance, and the accessibility of ownership and investment opportunities to local actors — areas whose further development remains an important direction for future research."

Comment 4: "I would also reconsider presenting Germany/NRW as a regulatory endpoint for which 'no recommendations' are required. The manuscript itself identifies limitations of the German system [...]. Germany/NRW can therefore provide a strong benchmark and valuable regulatory lessons without being presented as an optimal or completed model."

Authors' response: We accept this observation. A qualification has been introduced in Section 5.2. The revised text now reads: "This is not an omission, nor does it imply that the German framework constitutes an optimal model — as the limitations documented in Section 5.1 confirm — but an analytical finding." This reformulation maintains the analytical conclusion that no recommendations are directed at Germany or NRW — which remains valid — while explicitly acknowledging that the German framework is presented as a strong and instructive benchmark rather than a completed or optimal model.

Comment 5: "The opening sentence of the Methodology refers to the comparison of 'Germany and Galicia'. Given the two-level design subsequently described, this should presumably refer to Germany and Spain at state level and NRW and Galicia at sub-state level."

Authors' response: We accept this point. The opening sentence of Section 3 has been corrected to refer to Germany and Spain at state level and North Rhine-Westphalia and Galicia at sub-state level, consistently with the two-level analytical design described subsequently. The case selection paragraph has likewise been substantially revised to apply this framing throughout.

Comment 6: "The justification for describing NRW as a regulatory 'ceiling' and Galicia as a regulatory 'baseline' could also be more carefully formulated. Unless all German Länder and Spanish Autonomous Communities have been systematically assessed, the related expression 'maximum normative distance' appears stronger than the comparative evidence can establish."

Authors' response: We accept this comment. The revised case selection paragraph in Section 3 replaces "regulatory ceiling", "regulatory baseline" and "maximum normative distance" with more carefully calibrated language. NRW is now described as "the most analytically informative" sub-state case — combining a significant pre-existing tradition of community wind development with the most advanced sub-state regulatory framework in Germany — and the comparison is described as examining "a particularly enabling regulatory environment against a comparatively constrained one, in order to identify the range of regulatory variation and derive actionable reform lessons". An explicit caveat is added: "The findings should not be generalised mechanically to Germany or Spain as a whole: other Länder and other autonomous communities may present different regulatory configurations."

Comment 7: "Finally, the statement that the findings from CWPs are analytically generalisable to RECs more broadly should be reconciled with the Conclusion, which appropriately calls for future research to determine whether the patterns identified for wind are transferable to other technologies such as solar PV."

Authors' response: This apparent contradiction is resolved by the revised treatment of transferability in Section 3. Section 3 now distinguishes explicitly between dimensions of the analytical framework that are potentially transferable across CEP configurations — legal recognition, access to capital and proportionality of administrative procedures — and those that are technology- or scale-specific — territorial allocation, wind permitting and auction design. The conclusion's call for future research is therefore consistent with Section 3: it calls for empirical verification of the transferability of those dimensions already identified as potentially generalizable, rather than for a determination of whether any generalization is possible at all.

Comment 8: "the manuscript concludes by proposing distributive justice as a 'measurable and enforceable standard'. This is an interesting direction that could be developed further. Even without adding a quantitative assessment to the present study, the authors could briefly identify the types of indicators through which regulatory effectiveness and distributive outcomes might subsequently be evaluated."

Authors' response: We accept this suggestion. The characterization of distributive justice as

a 'measurable and enforceable standard' has been replaced by an evaluative standard whose practical operationalization is identified as a direction for future research, and which identifies the types of indicators through which such assessment might be conducted: the share of locally owned installed capacity, the proportion of wind energy rents retained within host territories, the degree of community participation in project governance, and the accessibility of ownership and investment opportunities to local actors. These indicators are drawn directly from the distributive justice dimensions operationalized in Section 2.2 and from the analytical focus of the study, rather than from external frameworks. We are grateful for the depth and thoughtfulness of your review, which has genuinely improved the manuscript. We remain available to address any further questions that may arise Best regards Xavier Simón

Competing Interests: No competing interests were disclosed.

Author Response 17 Sep 2026

Xavier Simon

Dear Andre Pacheco, We thank you for a thorough, constructive and generous assessment. Your comments have led to substantive improvements in the operationalization of the analytical framework, the consistency between methodological scope and interpretive claims, and the conceptual precision of the study. We address each point in turn.

Comment 1: "The first is the Operationalization and replicability of the comparative framework. The four analytical dimensions provide a clear structure for the study. However, the specific criteria through which these dimensions are assessed become apparent mainly in the Results rather than being explicitly defined in the Methodology. [...] I suggest adding a concise analytical matrix identifying, for each of the four dimensions: (i) the regulatory attributes examined; (ii) the evidence used to assess them; and (iii) the corresponding distributive-justice question."
Authors' response: We would like to express our particular appreciation for this comment, which we consider one of the most productive suggestions received across all reviews. The analytical matrix was implicit in our work from the outset — as the structure of Section 4 demonstrates — but your observation prompted us to make it explicit, and in doing so, helped us recognize and articulate the methodological coherence of our approach more clearly than the original manuscript achieved. We accept this suggestion and have introduced an analytical matrix in Section 3 (Table 1). The matrix identifies, for each of the five analytical units examined — legal recognition, territorial planning, financial mechanisms for project development, financial mechanisms for operational revenue, and administrative procedures — the regulatory attributes examined, the predominant sources of evidence mobilized at each institutional level, and the corresponding distributive justice dimension as operationalized in Section 2.2. Regarding sources of evidence, the matrix reflects the different institutional levels relevant to each dimension, ranging from EU directives and national legislation in legal recognition and financial mechanisms, to national and sub-state legislation and case law in territorial planning and administrative procedures. In all dimensions, these predominant sources are complemented by academic and grey literature, interpreted critically with attention to the potential interests of issuing

organizations. Regarding the distributive justice dimension, the matrix connects each analytical dimension directly to the four criteria operationalized in Section 2.2, without introducing new criteria. The matrix is followed by two new paragraphs addressing replicability and transferability, discussed further in our response to Comment 2 below.

Comment 2: "This clarification would also help qualify the claim that findings from CWPs are generalisable to the broader governance of RECs. Some of the criteria examined e.g., territorial allocation, wind permitting, auction design and high development costs, are particularly relevant to wind projects and may operate differently for other REC configurations. The authors should distinguish between findings that are potentially transferable across RECs and those that are technology- or scale-specific."
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Comment 3: "The Methodology appropriately acknowledges an important limitation: legal-doctrinal analysis establishes what regulatory frameworks provide for and their potential to enable or constrain community participation, rather than demonstrating what those frameworks produce in practice. I consider this distinction important and encourage the authors to apply it more consistently in the Discussion and Conclusions. Several statements move from identifying regulatory differences to stronger causal or outcome-based interpretations."*
Authors' response: We accept this criticism fully, and consider that addressing it has substantially strengthened the analytical coherence of the manuscript. Sections 1, 4, 5 and 6 have been reviewed in full to identify and reformulate all statements that moved from identifying regulatory differences to stronger causal or outcome-based interpretations. Specifically, the following reformulations have been introduced throughout the text to ensure consistency between the methodological scope of the study and the strength of the interpretive claims:

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reflected in the reformulations introduced throughout the text.
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Comment 4: "I would also reconsider presenting Germany/NRW as a regulatory endpoint for which 'no recommendations' are required. The manuscript itself identifies limitations of the German system [...]. Germany/NRW can therefore provide a strong benchmark and valuable regulatory lessons without being presented as an optimal or completed model."

Authors' response: We accept this observation. A qualification has been introduced in Section 5.2. The revised text now reads: "This is not an omission, nor does it imply that the German framework constitutes an optimal model — as the limitations documented in Section 5.1 confirm — but an analytical finding." This reformulation maintains the analytical conclusion that no recommendations are directed at Germany or NRW — which remains valid — while explicitly acknowledging that the German framework is presented as a strong and instructive benchmark rather than a completed or optimal model.

Comment 5: "The opening sentence of the Methodology refers to the comparison of 'Germany and Galicia'. Given the two-level design subsequently described, this should presumably refer to Germany and Spain at state level and NRW and Galicia at sub-state level."
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Comment 7: "Finally, the statement that the findings from CWPs are analytically generalisable to RECs more broadly should be reconciled with the Conclusion, which appropriately calls for future research to determine whether the patterns identified for wind are transferable to other technologies such as solar PV."
Authors' response: This apparent contradiction is resolved by the revised treatment of transferability in Section 3. Section 3 now distinguishes explicitly between dimensions of the analytical framework that are potentially transferable across CEP configurations — legal recognition, access to capital and proportionality of administrative procedures — and those that are technology- or scale-specific — territorial allocation, wind permitting and auction design. The conclusion's call for future research is therefore consistent with Section 3: it calls for empirical verification of the transferability of those dimensions already identified as potentially generalizable, rather than for a determination of whether any generalization is possible at all.

Comment 8: "the manuscript concludes by proposing distributive justice as a 'measurable and enforceable standard'. This is an interesting direction that could be developed further. Even without adding a quantitative assessment to the present study, the authors could briefly identify the types of indicators through which regulatory effectiveness and distributive outcomes might subsequently be evaluated."

Authors' response: We accept this suggestion. The characterization of distributive justice as a 'measurable and enforceable standard' has been replaced by an evaluative standard whose practical operationalization is identified as a direction for future research, and which identifies the types of indicators through which such assessment might be conducted: the share of locally owned installed capacity, the proportion of wind energy rents retained within host territories, the degree of community participation in project governance, and the accessibility of ownership and investment opportunities to local actors. These indicators are drawn directly from the distributive justice dimensions operationalized in Section 2.2 and from the analytical focus of the study, rather than from external frameworks. We are grateful for the depth and thoughtfulness of your review, which has genuinely improved the manuscript. We remain available to address any further questions that may arise Best regards Xavier Simón

Competing Interests: No competing interests were disclosed.

Reviewer Report 22 August 2026

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Giulio Ferla
[1] Politecnico di Milano, Milan, Italy
[2] Politecnico di Milano, Milan, Italy

The article examines how regulatory design may contribute to the different development of Community Wind Projects (CWPs) in Germany and Spain, with an additional comparison between North Rhine-Westphalia and Galicia. The topic is relevant, the manuscript engages with a broad and generally appropriate literature, and the two-level comparative framework is potentially valuable. However, some important methodological issues should be addressed before the article can be considered scientifically sound.
The main concern is the consistency between the research question and the adopted legal-doctrinal methodology. The paper asks to what extent regulation explains the different development of CWPs, but the current approach can identify regulatory differences and discuss how they may enable or constrain community wind development; it cannot determine their causal weight relative to historical, socioeconomic or cultural factors. This limitation is actually acknowledged by the authors and should therefore be reflected more consistently in the research questions, discussion and conclusions. The case-selection strategy also needs clearer framing, since NRW is intentionally chosen as a particularly advanced regulatory case rather than as a representative German Land; consequently, the results should not be generalised too directly to Germany and Spain as a whole.
A further important issue concerns methodological reproducibility. The manuscript refers to a systematic review conducted through Web of Science and Scopus, but does not provide search

strings, search dates, inclusion/exclusion criteria, screening procedures, or a transparent description of how legal and institutional sources were selected and classified within the four analytical dimensions. These elements should be reported, together with the documentary corpus or an analytical matrix as supplementary material. If such a reproducible protocol was not followed, the literature search should not be described as systematic.
The manuscript should also define more clearly what is meant by CWP and distinguish community ownership, renewable energy communities, citizen energy companies, local financial participation and benefit-sharing mechanisms, which are currently sometimes treated too closely. This is particularly important when interpreting the NRW framework. In addition, the claimed difference in CWP development between Germany and Spain should preferably be supported by a common and directly comparable indicator, rather than by different national statistics that do not measure exactly the same phenomenon.
Finally, some legal and factual information should be updated and verified, and several conclusions should be expressed more cautiously. In particular, the analysis supports the argument that some regulatory frameworks are more enabling for community participation, but it does not by itself demonstrate the magnitude of their causal effect on actual CWP deployment.
Overall, the manuscript has academic merit, but substantial methodological clarification, greater reproducibility, more precise terminology, and a more cautious interpretation of the findings are required.

Is the work clearly and accurately presented and does it engage with the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
No

Are all the source data and materials underlying the results available?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Building Physics; Building Energy Performance; Renewable Energy Systems; Energy Communities; Energy System Modelling and Decarbonisation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 03 Sep 2026

Xavier Simon

Mr. Giulio Ferla, Thank you very much for your interesting comments. We will begin working to provide you with a response. We are fully confident that your contributions will improve our work, and we think that perhaps your current decision could be reversed. Best regards

Competing Interests: No competing interests were disclosed.

Author Response 13 Sep 2026

Xavier Simon

Dear Giulio Ferla, We would like to thank you for a thorough and constructive assessment of our manuscript. Your comments have led to substantive improvements in the methodological framing, conceptual precision and interpretive caution of the article. We address each point in turn.
Comment 1: “The main concern is the consistency between the research question and the adopted legal-doctrinal methodology. The paper asks to what extent regulation explains the different development of CWPs, but the current approach can identify regulatory differences and discuss how they may enable or constrain community wind development; it cannot determine their causal weight relative to historical, socioeconomic or cultural factors. This limitation is actually acknowledged by the authors and should therefore be reflected more consistently in the research questions, discussion and conclusions."

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most representative German Land, but as the most analytically informative: it combines a significant pre-existing tradition of community wind development with the most advanced sub-state regulatory framework in Germany. The revised text also includes an explicit caveat: "The findings should not be generalised mechanically to Germany or Spain as a whole: other Länder and other autonomous communities may present different regulatory configurations. This limitation is inherent to case study research and does not diminish the analytical contribution of the study. The cases were selected for their analytical informativeness — not as a random or representative sample — and the regulatory instruments examined are drawn from legislation of general application within each system."

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explicit that CWPs pursue significant financial returns that are distributed locally with democratic governance, rather than subordinating financial objectives to social ones. Fourth, in Section 4.1 we have added a paragraph clarifying that the BürgEnG NRW mandates economic inclusion — financial participation — rather than community ownership in the full proprietary sense. The law requires that citizens and municipalities be offered a stake in the financial returns of new wind projects, but does not require governance rights commensurate with that stake. The NRW framework therefore represents a substantial advance in distributive terms relative to the Spanish and Galician baseline, but occupies an intermediate position between benefit-sharing and full community ownership on the distributive justice spectrum. Finally, we have replaced all nine occurrences of "REC/RECs" in the text — where used in the broad sense of community energy projects rather than the specific legal category of the Directive — with "community energy projects" or "CEPs", formally introducing the latter acronym in Section 2.1. The term "renewable energy communities" is now reserved exclusively for contexts where the article refers to the specific legal category of Directive 2018/2001.

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Competing Interests: No competing interests were disclosed.

Author Response 17 Sep 2026

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