In-depth assessment of energy transition policies: a comparative study between Proinfa (Ceará, Brazil) and Law 8/2009 (Galicia, Spain)

Avaliação em profundidade de políticas de transição energética: um estudo comparado entre o Proinfa (Ceará, Brasil) e a Lei 8/2009 (Galícia, Espanha)

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ABSTRACT

This article aims to conduct an in-depth comparative assessment of Incentive Programme for Alternative Sources of Electricity (Proinfa/Brazil) (with a focus on the implementation of the policy in Ceará) and the Galician Wind Energy Law (Law 8/2009), examining the extent to which these policy instruments have succeeded in reconciling sectoral expansion, territorial governance, and procedural and distributive justice. The analysis is grounded in the framework of in-depth public policy evaluation proposed by Rodrigues (2008) and adopts a qualitative and documentary approach to investigate the institutional trajectories and distributive impacts. The results indicate that, although both instruments have been effective in expanding installed capacity, significant distributive paradoxes remain. In Ceará, fragmented governance has intensified land conflicts in coastal areas, whereas in Galicia, centralised planning has resulted in high levels of litigation. The study concludes that the maturity of wind energy

policy depends on moving beyond investment security to consolidate effective mechanisms for procedural justice and the democratisation of benefits.

Keywords: Wind Energy. Public Policy Evaluation. Energy Justice. Ceará/Brazil. Galicia/Spain.

RESUMO

Este artigo tem por objetivo realizar uma avaliação comparativa em profundidade do Proinfa (com foco nos desdobramentos da política no Ceará) e da Lei Eólica galega (Lei 8/2009), examinando em que medida esses instrumentos lograram conciliar expansão setorial, governança territorial e justiça procedimental e distributiva. A metodologia ancora-se na perspectiva da avaliação em profundidade de políticas públicas proposta por Rodrigues (2008), adotando uma abordagem qualitativa e documental para analisar a trajetória institucional e os impactos distributivos. Os resultados evidenciam que, embora ambos tenham logrado êxito na expansão da capacidade instalada, persistem paradoxos distributivos significativos. No Ceará, a governança fragmentada catalisou conflitos fundiários em zonas costeiras; na Galícia, o planejamento centralizado resultou em elevada litigiosidade. Conclui-se que a maturidade da política eólica exige transcender a segurança do investimento para consolidar mecanismos efetivos de justiça procedimental e democratização dos benefícios.

Palavras-chave: *Energia Eólica. Avaliação de Políticas Públicas. Justiça Energética. Ceará/Brasil. Galícia/Espanha.*

1 INTRODUCTION

The rapid expansion of wind energy in recent decades has established this source as a strategic driver of global decarbonisation, playing a prominent role in the electricity mix of major economies such as China, the United States, the European Union, and Brazil. However, the large-scale deployment of this infrastructure has sparked intense debates on spatial planning and distributive justice, highlighting that the energy transition is not merely a technological process, but also a political and territorially situated phenomenon (Paulino et al., 2023).

As systematised by Frantál, Frolova, and Liñán-Chacón (2023), this process of territorialisation gives rise to a complex array of disputes, ranging from distributive injustice and nature conservation to changes in the values and functions of the landscape, thereby requiring governance arrangements capable of mediating conflicting interests. Without a fair social contract, decarbonisation risks reproducing inequalities and generating new forms of exclusion in the territories where it is implemented (Heffron; De Fontenelle, 2024).

In Brazil, the Incentive Programme for Alternative Sources of Electricity (Proinfa), established by Law No. 10.438/2002, represented a turning point in the national electricity matrix. Conceived as a strategic response to the 2001 electricity rationing crisis and to the vulnerability of hydroelectric dependence, the programme established long-term contracts and local content requirements to facilitate the integration of wind energy into the National Interconnected System (SIN). Although it fulfilled its role as a 'kick-start' policy, the absence of a coordinated national spatial planning framework resulted in fragmented governance, catalysing socio-environmental conflicts in coastal areas, with the state of Ceará serving as a particularly illustrative case. In this context, as Torres Junior (2021) warns in his analysis of Ceará, the developmentalist discourse of the state, centred on capital accumulation and technological advancement, often obscures the perception of locally borne negative impacts, resulting in a scenario of environmental injustice in which the promised benefits, such as employment and income generation, remain diffuse or unattainable for vulnerable populations.

In contrast, in Galicia, a region in north-western Spain, Law 8/2009 established a distinct model, one oriented less towards fostering a nascent sector and more towards the reorganisation of a field that

was already mature and pioneering within the Spanish context. The legislation established the Galician Wind Energy Sector Plan (PSEGA) as a binding instrument of spatial planning and environmental regulation and created fiscal mechanisms – namely the wind energy levy and the Environmental Compensation Fund – designed to balance the impacts and benefits associated with power generation. However, the sophistication of this regulatory framework did not eliminate the tensions between stated environmental objectives and regulatory practice, nor did it prevent the persistence of socio-environmental conflicts (Regueiro-Ferreira; Doldán-García, 2010). As argued by Paz Aldrey and Cortés Vázquez (2024), these conflicts and the recent high levels of litigation should not be interpreted merely as expressions of technological resistance, but rather as symptoms of a profound 'rural crisis', in which the energy transition overlaps with dynamics of depopulation, generating specific frictions concerning land use and the future of Galician rural communities.

In light of these contexts, comparing two regions marked by such distinct idiosyncrasies: on the one hand, Ceará, located in an emerging country and characterised by historical socio-environmental vulnerabilities; on the other, Galicia, subject to European Union regulation and endowed with a consolidated administrative framework. This contextual asymmetry is what makes a comparative assessment interesting, as it allows us to examine whether, despite institutional patterns, the global logic of the energy transition tends (or does not) to reproduce analogous patterns of territorial appropriation and concentration of power, thereby challenging the effectiveness of local regulatory instruments.

Concerning ecological sustainability, the expansion of wind power places specific pressures on highly sensitive ecosystems that cannot be overlooked. In Ceará, the installation of wind farms on shifting dune fields, interdune lagoons, and salt marshes has led to habitat fragmentation and heightened erosion risks, making the strict demarcation of exclusion zones and dynamic buffer areas essential (Loureiro et al., 2015; Preuss, 2020). Criticism centres on the inadequacy of gradual environmental assessments that ignore cumulative effects on biodiversity and ecosystem services in vulnerable coastal zones. In Galicia, however, the challenge lies in reconciling the exploitation of wind energy with the protection of natural and landscape values, particularly in repowering contexts that require reverse logistics to prevent the creation of new environmental liabilities (Regueiro-Ferreira; Cadaval-Sampedro, 2023).

The analytical challenge, in this sense, goes beyond the description of legal frameworks; it involves investigating the capacity of these institutional designs to reconcile environmental sustainability, social legitimacy, and distributive equity. Therefore, the perspective of 'in-depth evaluation' of public policies proposed by Rodrigues (2008) is adopted, as an approach that emphasises the need for dense, extensive and contextualised evaluations, integrating content, institutional trajectory, and the temporal and territorial scope of the instruments evaluated.

In this sense, the article aims to conduct a comparative evaluation between Proinfa (focusing on the policy developments in Ceará) and the Galician Wind Energy Law (Law 8/2009), investigating the extent to which their institutional designs articulate economic efficiency, environmental sustainability, and territorial equity. The analysis is guided by the following question: how do these regulatory frameworks, developed in disparate institutional contexts, structure – and limit – this articulation in the expansion of wind energy? By juxtaposing the debate on energy transition with the evaluation of public policies, the aim is to highlight convergences, asymmetries, and the distributional paradoxes that remain unresolved, even in contexts of apparent success in terms of installed capacity.

2 METHODOLOGY

This study adopts a qualitative, documentary, and comparative approach, grounded in the framework of in-depth public policy evaluation (Rodrigues, 2008). From this perspective, the evaluation goes beyond the measurement of specific indicators of effectiveness or efficiency and is organised around

four interdependent analytical dimensions: (a) policy content, including formulation, stated objectives, and internal coherence; (b) institutional trajectory and governance arrangements; (c) the context of formulation and implementation, with attention to the broader sectoral regulatory framework; and (d) the temporal and territorial scope covered, including its effects on the territories and social groups affected.

The methodological framework is based on a comparative case study of two instruments: Proinfa, established by Law No. 10.438/2002, focusing on its implementation in the state of Ceará, and Law 8/2009 on wind energy development in Galicia, including its main spatial planning instrument, the Galician Wind Energy Sectoral Plan (PSEGA), as well as the fiscal mechanisms of the wind energy levy and the Environmental Compensation Fund. The selection of these cases stems from their empirical relevance – both are structural milestones in wind energy expansion within their respective contexts – and their analytical comparability, since they face similar problems (diversification of the energy mix, territorial conflicts, social participation) through distinct institutional arrangements.

In terms of data sources, the research draws on:

1. Sectoral legislation and regulations: Law No. 10,438/2002 and sub-legal regulations associated with Proinfa (decrees, ministerial orders, Aneel regulations, and official documents from Eletrobras/ENBPar), as well as national and state environmental resolutions relevant to the licensing of wind farms in Ceará;

2. Galician regulatory frameworks: Law 8/2009, documents from the Xunta de Galicia on the PSEGA, regulatory acts relating to the wind energy levy and the Environmental Compensation Fund, as well as court rulings and official reports concerning litigation in the wind energy sector in Galicia;

3. Academic and technical literature: studies on the origins and development of the wind energy sector in both contexts, critical assessments of sectoral policies, and analyses of socio-environmental conflicts arising from the expansion of wind energy in north-eastern Brazil and Galicia.

Based on this documentary corpus, an analytical matrix was developed, organised into four axes of in-depth evaluation, which engage with the proposal by Rodrigues (2008):

1. Objectives and historical-institutional context: examination of the contexts of origin of each instrument (the crisis of rationing and hydroelectric vulnerability in the Brazilian case; the consolidation of a pioneering sector and alignment with European directives in the Galician case), as well as the primary and secondary objectives and stated targets.

2. Regulatory practices and governance instruments: analysis of procurement mechanisms, cost and compensation structures, land-use planning arrangements, and mechanisms for regulatory stability and coordination between levels of government.

3. Social participation and procedural justice: identification of the envisaged participation mechanisms (public hearings, consultations, public information), of criticisms regarding their effectiveness, and of the gap between formal participation and the actual influence of local

communities, both in Brazilian licensing and in the application of the Galician environmental and territorial framework.

4. Territorial and distributional impacts: analysis of the concrete effects of the policy on territories, including sectoral development, public revenue, distribution of benefits and burdens, as well as socio-environmental conflicts and patterns of litigation, with particular attention to coastal municipalities in Ceará and Galician districts with a strong wind energy presence.

The interpretation of the data followed an inductive analytical-interpretative approach, linking the empirical findings with the theoretical framework on energy transition, territorial governance, and environmental justice. Rather than testing strict causal hypotheses, the aim was to provide a critical analysis of the convergences and divergences between the two instruments, highlighting the paradoxes and tensions that arise from attempts to reconcile the rapid expansion of wind energy infrastructure with social legitimacy and territorial equity.

Regarding the ethical aspects of the research, it should be noted that this study is based on the analysis of public documentary sources, such as legislation, institutional reports, and previously published academic literature, and does not involve the collection of primary data from human participants. Consequently, there was no need for submission to a research ethics committee, in accordance with current guidelines for documentary research.

3 RESULTS AND DISCUSSION

Considering the institutional and regulatory frameworks that shaped Proinfa (Law No. 10.438/2002) in Brazil, with particular reference to the State of Ceará, and the Galician Wind Energy Law (Law 8/2009) in Spain, it is pertinent to conduct a comprehensive comparative assessment. This analysis aims to understand how the stated objectives, regulatory instruments, mechanisms for public participation, and concrete territorial effects have materialised in distinct socio-economic and political contexts. While Proinfa represented an initial effort to diversify the Brazilian electricity mix, standing out for its focus on security of supply, nationalisation of the production chain, and the controlled integration of new sources, the Galician Wind Energy Law consolidated a model of territorial governance that combines spatial planning, environmental compensation, and the distribution of local benefits.

In this regard, the study seeks to identify convergences and asymmetries between the two experiences, examining both the institutional design and the coherence of their instruments, as well as the forms of public participation, procedural justice, and the distribution of benefits and burdens of the energy transition in the affected territories. The aim is to demonstrate the extent to which each policy was able to articulate environmental sustainability, social legitimacy, and regulatory and economic effectiveness, and how its practices shaped, positively or negatively, the energy transition process at a regional scale.

Thus, this analysis goes beyond a normative and institutional description by examining the structural and socio-territorial implications of each instrument, enabling an understanding of how the regulatory, participatory, and distributive dimensions converge or diverge in the configuration of public renewable energy policies with varying degrees of equity and territorial integration.

Proinfa and the Galician Wind Energy Law (Law 8/2009) were established in very different economic and energy contexts. While Brazil was responding to a supply crisis and a heavy reliance on hydroelectric power, Galicia aimed to consolidate and regulate a wind energy sector that was already mature and pioneering in the region, within the context of state reforms and European directives. In this regard, Table 1 below summarises the historical and institutional context in which each instrument emerged, its primary and secondary objectives, and the original targets that guided its implementation.

Table 1 – Objectives and historical context

Dimension	*Proinfa (Law No. 10.438/2002)*	*Galician Wind Energy Law (Law 8/2009)*
Context of Origin	Response to the 2001 rationing crisis and the vulnerability of the hydroelectric grid, with a need for diversification and security of supply (Brazil, 2002a; Kelman, 2001; Tolmasquim, 2012). Preceded by reforms that failed to expand capacity in line with demand (Brazil, 1995, 1996).	Consolidation of an already pioneering and mature wind power sector in Galicia, which was linked to the special state remuneration scheme and European directives (European Union, 2001; Inega, 2007; Spain, 2007). Galicia already had a consolidated installed renewable energy base prior to 2009 (REE, 2009).
Primary Objective	To increase the share of wind, small hydro, and biomass in the National Interconnected System (SIN) (Brazil, 2002a). Proinfa functioned as a start-up policy (Brazil, 2003; IEA, 2024).	To plan wind energy development through the Galician Wind Energy Sector Plan (PSEGA) and regulate the administrative authorisation regime (Galicia, 2009, art. 1). Its focus is on binding spatial planning (Xunta de Galicia, 1997).
Secondary Objectives	Strengthening security of supply and stimulating the national production chain through local content requirements (60% in Phase I) (Brazil, 2003).	To establish mechanisms for territorial balance and the sustainability of natural resources, such as the wind energy levy and the Environmental Compensation Fund (Galicia, 2009, Art. 1, Art. 7). This aims to reduce the number of turbines and protect the environment (Galicia, 2009, Art. 7).
Original Targets	Phase I: 3,300 MW (1,100 MW per source); Phase II: 10% of annual electricity consumption (Brazil, 2002a). Phase II was not implemented, giving way to the auction model (ACR) (Brazil, 2004b; IEA, 2024).	To organise wind energy development in Galicia, ensuring the rational distribution of installed capacity (Xunta de Galicia, 2010).

Source: The authors (2026)

Proinfa was conceived in 2002 as a strategic response to the 2001 rationing crisis, aiming to reduce the vulnerability of the hydroelectric matrix and stimulate industrial development (Brazil, 2002a; Tolmasquim, 2012). The programme established expansion targets (3,300 MW in Phase I) and utilised local content requirements (60% in Phase I) to foster domestic industry (Brazil, 2003). However, the more ambitious Phase II was not implemented, as expansion shifted to the auction model (Brazil, 2004b; IEA, 2024). In contrast, Law 8/2009 in Galicia was introduced to regulate and provide compensation to a sector that was already mature and consolidated (REE, 2009). Its main tool was the PSEGA, which established binding territorial planning (Galicia, 2009; Xunta de Galicia, 1997) and created fiscal instruments such as the wind energy levy to ensure sustainability and territorial balance (Galicia, 2009, art. 7).

The main similarities observed in the two contexts lie in the role of both instruments as drivers of modernisation and diversification of the energy mix, seeking security of supply and the growth of the wind energy sector on a large scale. However, the greatest divergence lies in the temporal motivation and focus of the policies. Proinfa was an emergency and induction policy, focused on creating a market where it was in its infancy – that is, a start-up programme – using subsidies and industrial policy as its structural foundations. The Galician Wind Energy Law, on the other hand, was instituted as a policy for planning and conflict management within an already established sector – in which centralised territorial planning was the priority, and compensation was provided through fiscal mechanisms rather than tariff subsidies.

In this sense, moving from an analysis of objectives and historical contexts to that of regulatory practices, it can be observed that the differences in origin result in contrasting institutional arrangements. Whilst Proinfa consolidates a model of centralised coordination through contractual and tariff-based mechanisms, the Galician Wind Energy Law establishes a centralised territorial coordination framework, based on binding spatial planning and fiscal redistribution instruments. These distinctions are summarised and detailed in Table 2 below, which highlights the regulatory mechanisms adopted in

each context and their implications for the balance between economic efficiency, territorial governance, and distributive equity.

Table 2 – Regulatory practices

Dimension	*Proinfa (Law No. 10.438/2002)*	*Galician Wind Energy Law (Law 8/2009)*
Procurement Mechanism	Long-term contracts (20 years), centralised by Eletrobras, with prices set at 'economic value' (with specific tariff floors per source in Phase I) (Brazil, 2003; Brazil, 2004a). Selection prioritised the stage of environmental licensing (LI > LP) (Brazil, 2002a).	Authorisation procedure based on free competition, transparency, and administrative streamlining (Galicia, 2009, Art. 1). Authorisation is linked to competitive public calls for tenders (Xunta de Galicia, 2010), within the limits of the Galician Wind Energy Sector Plan (PSEGA) (Galicia, 2009).
Cost Structure / Compensation	Tariff socialisation of costs via the Proinfa Account, apportioned across all consumption categories (excluding low-income households) (Brazil, 2002a; Brazil, 2004a). The average approved cost in 2025 was R$ 543.56/MWh (Aneel, 2024).	Fiscal-territorial instruments: the wind energy levy (tax on installation/operation) and the Environmental Compensation Fund (FCA), designed to ensure territorial balance and environmental compensation (Atriga, 2025; Galicia, 2009). The FCA generates around 22–22.4 million euros annually (Europa Press, 2025; La Voz de Galicia, 2024).
Land Use Planning	It did not contain explicit federal territorial guidelines for sensitive areas, relying on Conama Resolutions (e.g. Conama, 2014) and state Coema Resolutions (e.g. Ceará, 2018a). It used state-level limits to prevent geographical concentration (Brazil, 2003).	The PSEGA has sectoral planning authority and takes precedence over municipal urban plans (Galicia, 2009; Xunta de Galicia, 1997). This has created tensions between regional planning and local urban planning (Romero, 2012).

Source: The authors (2026)

Proinfa was a market-guarantee instrument that used 20-year contracts and stable prices (above the initial competitive market rate) to mitigate the risk of investment in nascent energy sources (Brazil, 2003; Chaves; Azevedo; Fernandes, 2023). This predictability was financed by the Proinfa Account, a cross-subsidy apportioned across the tariff (Aneel, 2004). Brazilian spatial planning for wind power was, however, fragmented, dependent on environmental licensing in each state and on prioritisation rules under the Installation Licence (LI) (Brazil, 2004a). In turn, Law 8/2009 ensured stability through centralised spatial planning (PSEGA), which bindingly defines the zones for development (Galicia, 2009). The compensation mechanism is fiscal in nature, as the *wind energy levy* is a direct tax on projects that feeds into the Environmental Compensation Fund (FCA), intended to channel part of the proceeds towards nature conservation and territorial rebalancing (Europa Press, 2025; Galicia, 2009).

The main regulatory similarity observed is the commitment to stability and predictability for investors, which is essential for long-term infrastructure projects. Both models sought to prevent excessive geographic concentration, whether through per-state capacity limits in Proinfa or through sectoral planning in PSEGA. The main divergence lies in financing and land use planning. Proinfa used consumer tariffs to subsidise (tariff socialisation), whereas Galicia used a tax on generation (*wind energy levy*) as compensation (fiscal mechanism). Furthermore, the Galician model imposed centralised and binding territorial planning on municipal authorities, something absent in the Brazilian Proinfa, which relied on local environmental regulations.

Thus, moving from the regulatory sphere to the consideration of social participation, a critical and fragile dimension becomes evident in both cases. As shown in Table 3 below, participation emerges as the most sensitive aspect of energy transition governance, characterised by the prevalence of formal and technocratic procedures that reduce the effective influence of local communities on route planning, licensing, and the distribution of benefits generated by wind energy projects, and this is evident in both the Ceará and Galicia cases:

Table 3 – Levels of Social Participation

Dimension	*Proinfa (Law No. 10.438/2002)*	*Galician Wind Energy Law (Law 8/2009)*
Mechanisms and Practices	Participation focused on the requirements of environmental licensing (public hearings, formal consultations) (Gorayeb; Brannstrom, 2020). There is criticism of the use of the Simplified Environmental Report (SER) in complex areas (Pereira, 2022; Sobrinho; Santos, 2022), which reduces deliberative windows (Leite, 2022).	Participation anchored in Law 21/2013 on Environmental Assessment (public information and consultations) and the Aarhus Convention (Spain, 2006; Spain, 2013). Law 8/2009 provides for administrative streamlining (Galicia, 2009).
Criticisms of Effectiveness	It presents a "social gap" (the distance between formal participation and actual impact) (Gorayeb; Brannstrom, 2020; Sobrinho; Santos, 2022). Participation tends to be informative and ex post, with no real power to alter plans or redistribute gains (Lima, 2024). Conflicts arise from information asymmetry (Silva; Rojas-Pinilla, 2023).	The regulatory framework has been criticised for its technocratic rationality and for lacking effective mechanisms for social participation and equitable distribution (Chacón; Frolova, 2024; Regueiro-Ferreira; Doldán-García, 2010). Participation is often viewed as a formal requirement (Romero; Farinós, 2011).
Social Vulnerabilities	The projects affect sensitive areas, such as shifting dunes and sandbanks, and traditional communities (fishing and quilombola communities), leading to territorial conflicts and inequalities in the distribution of benefits (Gorayeb; Brannstrom, 2020; Lima, 2024).	The Law suffers from practical gaps in social compensation. Although a levy exists, its effectiveness depends on binding programme targets, which have not translated proportionally into benefits for local communities (Heffron; De Fontenelle, 2024; Regueiro-Ferreira, 2023).

Source: The authors (2026)

The lack of participation in Proinfa is evident in Ceará through the use of the Simplified Environmental Report (RAS) in highly sensitive ecosystems, such as dunes and sandbanks, which limits the scope of the assessment and the quality of public deliberation (Pereira, 2022; Sobrinho; Santos, 2022). This creates a "social gap" in which community involvement is a formalised, standardised process, but one that in practice lacks effectiveness or *ex post* power, with no real ability to alter projects or ensure distributive justice (Gorayeb; Brannstrom, 2020; Lima, 2024). In Law 8/2009, the problem lies in the technocratic rationality imposed by the PSEGA (Regueiro-Ferreira; Doldán-García, 2010). Although the environmental framework is formally sound (Espanha, 2013), the pursuit of administrative efficiency has led to procedural flaws (such as the shortening of consultation periods), resulting in judicial annulments that confirm the fragility of effective participation (De La Justicia, 2024; Mora Ruiz, 2025).

The main convergence lies in the diagnosis of participation as a formal ritual. In both cases, the logic of energy efficiency and the imperative to attract private capital have overridden the need for democratic legitimacy and procedural justice. The result is an asymmetry of power and information between companies and communities. What distinguishes this situation across different territories is merely the origin of the procedural flaws. In Brazil, the problem is structural, linked to the weakness of environmental impact assessments (EIA) in vulnerable territories. In Galicia, the problem is systemic and legal, centred on the tension between centralised regional planning and the application of legal consultation standards (Aarhus Convention), with judicialisation being the main battleground against regulatory technocracy.

From this point, it follows that we must move from procedural criticism to the concrete effects of the policies in the territories. In both contexts, the expansion of installed capacity was unequivocal; however, its consequences reveal a distributive paradox: the concentration of corporate power coexists with the persistence of localised conflicts, especially where land use puts pressure on sensitive ecosystems

and traditional ways of life. Thus, we turn to the analysis in Table 4, which comparatively examines the observed impacts (from sectoral development to public revenues and litigation), enabling us to identify the extent to which regulatory and participatory arrangements have (or have not) translated into tangible and equitable benefits for host communities.

Table 4 – Observed Impacts in the Territories

Dimension	*Proinfa (Ceará, Brazil)*	*Galician Wind Energy Law (Galicia, Spain)*
Sectoral Development	This was the starting point of the learning curve and the formation of the National Wind Energy Sector (Araújo; Willcox, 2018; Diniz, 2018), reducing technological and market risks (Chaves; Azevedo; Fernandes, 2023). A subsequent expansion shifted towards competitive auctions (Brazil, 2004b).	It consolidated wind power as a pillar of the energy mix (38.4% of production in 2024), working synergistically with hydropower (REE, 2025). It strengthened the regional governance of the sector (Galicia, 2009).
Distribution of Benefits	There has been growth in municipal revenues (ISSQN and share of ICMS), GDP per capita and sectoral value added in host municipalities (Sampaio; Costa; Irffi, 2025; Velôso et al., 2025). However, there is evidence of land reconcentration and inequality in the appropriation of gains (Gorayeb; Brannstrom, 2020; Lima, 2024).	Fiscal instruments generate significant revenue (around €22 million/year) (Europa Press, 2025), but a high concentration of ownership among large groups persists (Regueiro-Ferreira; Doldán-García, 2020). Revenue gains do not translate into proportionate socio-economic benefits for local communities (Regueiro-Ferreira, 2023; Valle et al., 2024).
Conflicts and Litigation	Recurring conflicts in sensitive coastal areas, such as the Cumbe and Icaraizinho complexes (Lima, 2024; Sousa; Moura; Souza, 2023). Legal disputes persist regarding land ownership, environmental damage, and the adequacy of studies (Mendes; Collaço, 2024).	Law 8/2009 faced intense judicialisation. In August 2025, 92 parks were subjected to litigation, and 86 were provisionally suspended (Galician Regional Government, 2025a). Tensions are exacerbated by the prevalence of regional over municipal urban planning (Romero, 2012).

Source: The authors (2026)

The impact of Proinfa in Ceará highlights the dichotomy between economic success and social failure. There has been an increase in municipal tax revenues and sectoral development (Diniz, 2018; Sampaio; Costa; Irffi, 2025); however, this growth came at the cost of intensified conflicts, such as in Cumbe and Icaraizinho, resulting in land concentration and the exclusion of traditional communities from participating in the benefits (Gorayeb; Brannstrom, 2020; Lima, 2024). Meanwhile, Law 8/2009 consolidated Galicia as a wind power hub (REE, 2025) and secured a stream of fiscal compensation (the *royalty*) that raises millions annually (Europa Press, 2025). However, this wealth is accompanied by a persistent concentration of ownership in large groups (Regueiro-Ferreira; Doldán-García, 2020). The failure to deliver proportional benefits and the inadequacy of cumulative environmental studies have resulted in widespread litigation, with dozens of wind farms provisionally suspended until 2025 (Xunta de Galicia, 2025a).

The main similarity between the contexts lies in the distributional paradox inherent in both large-scale models. In both territories, wind energy expansion has generated wealth (fiscal or tax revenue) that has not benefited the communities bearing the environmental and territorial costs equitably, thereby reinforcing the concentration of corporate power. The main difference observed lies in the way conflicts manifest and are managed. In Brazil (specifically in Ceará), the impacts are strongly linked to socio-environmental vulnerability and conflicts over land tenure (encroachment on dunes, impacts on small-scale fishing). In Galicia, the most evident impact is legal instability and high levels of litigation, where communities and environmental groups use the judicial system to challenge the legality of regional planning and the validity of environmental procedures.

Thus, by bringing together the four axes analysed – objectives and historical contexts, regulatory practices, social participation and territorial impacts – it is evident that both Proinfa and the Galician Wind Energy Law stand out as effective instruments from the perspective of sectoral expansion, yet are limited in terms of territorial and distributive justice. Both have succeeded in establishing wind energy as a driver of modernisation and energy transition, yet without ensuring, to an equivalent degree, the democratisation of benefits and social inclusion in the affected territories, corroborating the arguments of Heffron and De Fontenelle (2024) regarding the persistence of energy justice deficits even in contexts of institutional progress.

In the Brazilian context, the absence of a national spatial planning framework and the reliance on fragmented environmental regulations have produced reactive governance, marked by localised conflicts and predominantly formal social participation, showed incapability of correcting asymmetries in economic and informational power, thereby standing in line with the 'social gap' identified by Gorayeb and Brannstrom (2020) and with the empirical evidence presented by Lima (2024) and Silva and Rojas-Pinilla (2023). In Galicia, however, although the binding territorial model and fiscal instruments bring to the front greater institutional sophistication, the technocratic emphasis and the prevalence of regional planning over municipal autonomy have ultimately shifted the conflict to the judicial arena, increasing litigation and contesting the legitimacy of decision-making processes, as analysed by Chacón and Frolova (2024), and Regueiro-Ferreira and Doldán-García (2010).

Thus, both contexts reflect a key issue regarding the contemporary energy transition, namely the reconciliation of economic efficiency, environmental sustainability, and social equity. Success in terms of installed capacity and revenue generation has not translated into proportional redistributive benefits, nor into lasting institutional stability, which aligns with the typology of territorial conflicts proposed by Frantál, Frolova and Liñán-Chacón (2023). Therefore, the comparison shows that the true maturity of a wind energy policy is not measured solely by the number of megawatts installed, but by the ability to integrate energy development with territorial development, promoting procedural justice, effective participation, and the equitable distribution of the benefits of the transition.

4 FINAL CONSIDERATIONS

The in-depth comparative assessment between Proinfa, in Ceará, and the Galician Wind Energy Law brings to light a troubling diagnosis regarding the contemporary energy transition: technological and market success does not, in itself, guarantee territorial justice. The analysis demonstrates that both instruments, although conceived in disparate institutional contexts and with distinct levels of regulatory sophistication, ultimately converged in producing an exclusionary modernisation. The success in expanding installed capacity, undeniable in both cases, operated under a logic that prioritised investor security at the expense of distributive equity, creating a paradox where energy is renewable, but power practices reproduce old asymmetries.

In the Brazilian case, it can be concluded that Proinfa fulfilled its role as an industrial 'kick-start', but failed in its territorial integration. Fragmented governance and dependence on asymmetrical environmental licensing transformed the territory of Ceará into a battleground, where the speed of expansion infringed on the rights of traditional communities. In Galicia, however, the problem was not a lack of regulation, but an excess of technocracy. Law 8/2009, with its binding planning and fiscal instruments (the *canon*), created an appearance of order that did not stand up to the test of social legitimacy, resulting in a massive wave of legal challenges that exposes the rift between centralised planning and local will.

Thus, this study has shown that the maturity of a wind energy policy can no longer be gauged solely by the volume of *megawatts* or the robustness of its financial contracts. True maturity lies in the ability of the state to reconcile decarbonisation with democracy. Comparative evidence from Ceará and Galicia

shows that command-and-control instruments (such as the PSEGA) or purely economic incentives (such as the Proinfa) are insufficient to mitigate conflicts if they are not grounded in substantive procedural justice.

In light of these dynamics, the article argues that the energy transition risks becoming a new driver of inequality, unless there is a change of course. The differences between the cases – land tenure vulnerability in Ceará versus legal-institutional tension in Galicia – are merely local manifestations of the same global phenomenon: the deterritorialisation of energy decisions.

Furthermore, the article proposes the need for a 'second generation' of wind energy policies, guided by a paradigm of just and territorially integrated transition. This implies shifting the focus from rapid expansion and corporate profitability to the effective incorporation of social and territorial dimensions, requiring that planning, financing, and compensation instruments be designed in alliance with the territories, and not only for the use of the territories. Without this ethical and political shift, wind energy, whilst carbon-clean, will remain 'dirty' in social terms, replicating power structures that the very idea of sustainability was meant to overcome.

In this context, although the study offers relevant contributions to the comparative understanding of wind energy governance, certain limitations must be acknowledged. The analysis is based predominantly on primary sources, which limits direct insight into the perceptions and strategies of local actors, whilst the territorial scope – centred on Ceará and Galicia – does not allow for automatic generalisations to other contexts. Nevertheless, these limitations do not undermine the findings but indicate the need for further empirical investigation through field research that incorporates local dynamics and the experience of affected communities. In this regard, the results also point to relevant implications for public policy formulation, highlighting the importance of integrating effective mechanisms for social participation, territorial redistribution of benefits, and planning sensitive to socio-environmental specificities. Thus, a research agenda is opened up focused on the analysis of different institutional arrangements and their repercussions on energy justice, contributing to the development of more equitable and territorially integrated energy transition models.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

The authors used ChatGPT (OpenAI, version 5.1) for language editing and stylistic polishing only. All scientific content, analysis, and intellectual input were developed and verified by the authors; we take full responsibility for the accuracy and integrity of the manuscript.

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