



Perspectives

Wind power gone bad: Critiquing wind power planning processes in northeastern Brazil

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ABSTRACT

Social and political opposition to wind power in North America and Europe has complex origins, but recent analyses emphasize exclusionary planning processes and human attachment to cultural and physical landscapes. In the global South, knowledge is far less developed regarding reasons for opposition to wind power. Physical and economic marginalization of affected people, whose lands may be appropriated for wind farms, from the positive benefits of renewable power is thought to motivate opposition. We analyze results of pilot research on the planning and licensing process and mitigation policies responding to negative impacts of a wind farm in Ceará state, Brazil. The pilot work reveals flaws in siting wind farms and need for more careful approaches to mitigation policies. These preliminary findings suggest the need to modify policies and procedures governing Brazil's wind-power development and in locations elsewhere in the global South.

1. Introduction

A globally significant cluster of wind farms has developed in coastal areas of northeastern Brazil in response to government subsidies, high wind quality, and increasing demand for electricity. Installed wind power capacity (11.2 GW) places Brazil as the world's ninth-largest player and Latin America's leading country [1]. Rapid increases in capacity occurred in Ceará state, from 28.6 MW in 2005 [2] to 1.7 GW in July of 2017 [3]. Overall in Brazil, hydropower accounts for 66% of Brazil's total electricity generation, followed by natural gas (10%), biomass (8%), and wind (6%) [3]. Wind power may reach nearly 24 GW (12% of power generation) by 2024 [4].

This cluster of wind power generation resulted from an electricity crisis in 2001 caused by low water levels in reservoirs supporting hydroelectricity plants, leading to power outages and approximately US \$10 billion in economic losses [5]. In response to the power crisis, government subsidies such as state-led auctions, reduced import duties, streamlined licensing, and finance from the national development bank stimulated wind farm construction [6,2,7], and high wind quality coinciding with low hydropower output [6,8]. Optimistic engineering estimates indicate that wind penetration in northeastern Brazil could reach 55% from 16 GW installed capacity by 2020 [9].

Most reports on Brazilian wind power ignore social, political, or

environmental problems and portray utility-scale wind power as a “win-win situation” for the country ([6], p. 833). Wind farms “harmoniously share land with the original farm and ranch activities” while offering rents to landowners ([7], p. 441). Government documents describe wind power as “practically inoffensive” that should be implemented with “simplified means without requiring detailed and lengthy environmental impact studies” ([10], p. 3).

Injustices in siting processes and material benefits and disruptions to place attachment contribute to the “social gap” between broad support for renewable power and site-specific opposition [11,12]. Opposition to renewable power in North America and Europe originates from diverse and complex sources ranging from socioeconomic aspects to aesthetics and environmental concerns [48]. Another source of opposition results from challenges of renewable power to human attachment to cultural and physical landscapes [13–15].

Causes of social opposition to renewable energy outside the global North are poorly understood. In Mexico, procedural injustice and land tenure insecurity helped generate opposition [6,16–18], while top-down plans for solar power in Morocco have violated land claims [19]. In India, Yenneti et al. [20] argued that solar projects enclosed common land and harmed livelihoods. The emerging research gap in the global South includes the need to understand processes of siting decisions, land dispossession, and place attachment in determining opposition to

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renewable power development across a geographically diverse range of complex land tenure arrangements and socio-political systems. It is important to fill this knowledge gap because large land demands of utility-scale wind and solar power may generate a global land rush and produce social conflicts that strain weak political and economic institutions [21,22].

In this “Perspectives” essay we present results of a pilot study of an emblematic wind farm on the west coast of Ceará, Brazil, focusing on (1) how the planning processes “erased” a traditional community, making residents “invisible” to decision makers who provided necessary state approvals for construction of the wind farm and (2) unintended effects of a mitigation program. Social opposition, rooted in claims to land and resources occupied by the wind farm, led to mitigation efforts that produced mixed results for the community. Flaws in the licensing process and unintended consequences of mitigation efforts may be present in many other locations of wind power development but are not yet reported in the scholarly literature.

2. Background

Social scientists studying wind-power siting controversies in North America and Europe emphasize how the planning process, place attachment, and material benefits determine whether wind-power projects fail or succeed [23,15]. An example of institutional, financial, and multidimensional factors is the technocratic siting process, described by Baxter et al. [24] as “decide-announce-defend,” which helped produce conflicts within communities hosting wind power in Ontario, Canada [25]. Procedural injustices, originating from technocratic planning processes that marginalize people from decision making, are a major source of opposition [26–28]. Distributional injustice, which describes how negative impacts are often felt by people who are not compensated for harms, adds to opposition [29]. When analyzed together using hypothetical wind farms in Europe, procedural justice is thought to have greater importance than distributional justice in determining social acceptance of wind power [30]. Wolsink [31], reporting on opposition to a coastal Netherlands wind farm, offered a similar critique of a “technocratic, top-down” decision to site turbines on a nearshore environment. Sovacool and Ratan [32] argue that participatory project siting is associated with sites of renewable power acceptance, a view supported by Pasqualetti [13,14], who argued that “imposition” of wind power spurred opposition among people whom wind farms had marginalized from resources without compensation.

Negative consequences of the “decide-announce-defend” model have been described by Juárez-Hernández and León [6], Huesca-Pérez et al. [17], and Rueda [16] for Mexico, while a synthesis of conflicts in northeastern Brazil revealed the importance of land-tenure insecurity [33], as suggested by Pasqualetti [13,14]. Rignall [19] studied the visibility of marginalized people by detailing “legal and bureaucratic procedures” that erased “political and resource claims” of people living near a solar energy project covering 3000 ha in Morocco. Government classifications of “waste” land helped authorities obtain land for a solar project in western India [20].

In Brazil, an important legal instrument supporting “decide-announce-defend” is simplified environmental licensing (*Relatório Ambiental Simplificado*; hereafter, RAS) for energy projects considered to have low environmental impact, including wind farms and other renewable energy projects [34]. Brazil’s 2001 electricity crisis provided political cover for federal authorities to create a streamlined procedure for environmental licensing that would accelerate power generation: investors only had to present the RAS, which includes a declaration of the technician responsible stating that the project had low potential for environmental impact; a maximum 60-day period was imposed for licensing projects that were seen as necessary to increase electricity supply in Brazil. Notably, the RAS outlived the electricity crisis and was further institutionalized in 2014, when a federal environmental council issued a requirement that a full environmental impact report would be

required only if wind farms were implemented in “fragile” environments such as dune fields and mangroves, or if wind farms required communities to be relocated [35].

However, Ceará notoriously lacks infrastructure, information, and bureaucratic controls that would reduce abuses in the RAS regime. For example, the owner of the largest environmental consulting firm hired by wind-energy firms in Ceará, which produced 50% of the RAS for Ceará’s operational wind farms [36], was sentenced in 2014 to 32 years in prison for having produced biased environmental impact studies. A federal police operation, begun in 2008, apprehended complicit state environmental managers for issuing fraudulent licenses, although the guilty parties are appealing the sentence and verdict without having been jailed [37]. Moreover, demarcation of federal and private land in coastal Ceará has never been carried out, creating land tenure insecurity for traditional communities. These institutional weaknesses exist in a context where nearly 90% of Ceará’s wind farms are located on or near dunes, beaches, and mangroves in search of high-quality wind. But these are also sites settled by traditional communities who engage in artisanal fishing and small-scale agriculture, often without formal legal title to land.

3. Methods and study site

Our findings are informed by several periods of field work in a community in coastal Ceará state that was the location of a 104 MW wind farm with 50 turbines (Fig. 1). The Praia Formosa wind farm, which started operation in August 2009, has the capacity to supply 7% of the state’s electricity demand. The community, known as Xavier, is a traditional settlement of 22 families (66 residents) who rely on fishing with non-motorized boats, collection of shellfish and shrimp, and small-scale agriculture. No tourism infrastructure is present.

Between 2010 and 2016 our research in Xavier included several activities with community participation, such as participant observation, group workshops, transect walks, construction of a problem-potential matrix, and collective discussion regarding land-use planning, in addition to a structured survey and analysis of textual materials. Field notes and recordings from interviews were transcribed and organized according to major emergent themes. Participatory field work provided us with the knowledge to analyze documents contained in the RAS licensing process, obtained in the library of the state environmental licensing agency (Superintendência Estadual do Meio Ambiente do Ceará; SEMACE) in Fortaleza, the capital of Ceará state.

4. Results

Residents of Xavier beach did not have access to preliminary information regarding construction of the wind farm, conforming to the “decide-announce-defend” siting model, even though this is required under Brazilian law [34]. According to residents, technical staff from the wind power firm started surveying houses in 2005, shortly after the state government installed an anemometer ~20 km from Xavier [38]. The community receives no financial benefit from the wind farm such as rents, royalties, or social or community services even though construction of the wind farm buried interdunal lakes, impeded free access to goods and services outside the community, and created fear after one turbine exploded [39]. Below we discuss specific events and processes below that encouraged conflict.

4.1. Cartographic and physical erasure

Cartographic erasure is apparent on a 2002 map contained in the RAS. The map has several technical errors and omissions, the most egregious of which is the fact that the community living at Xavier Beach was not depicted. Fig. 2 compares the map in the RAS with the wind farm as built on dunes next to the Xavier community.

Only 200 m separate the nearest house from a wind turbine (Fig. 3),

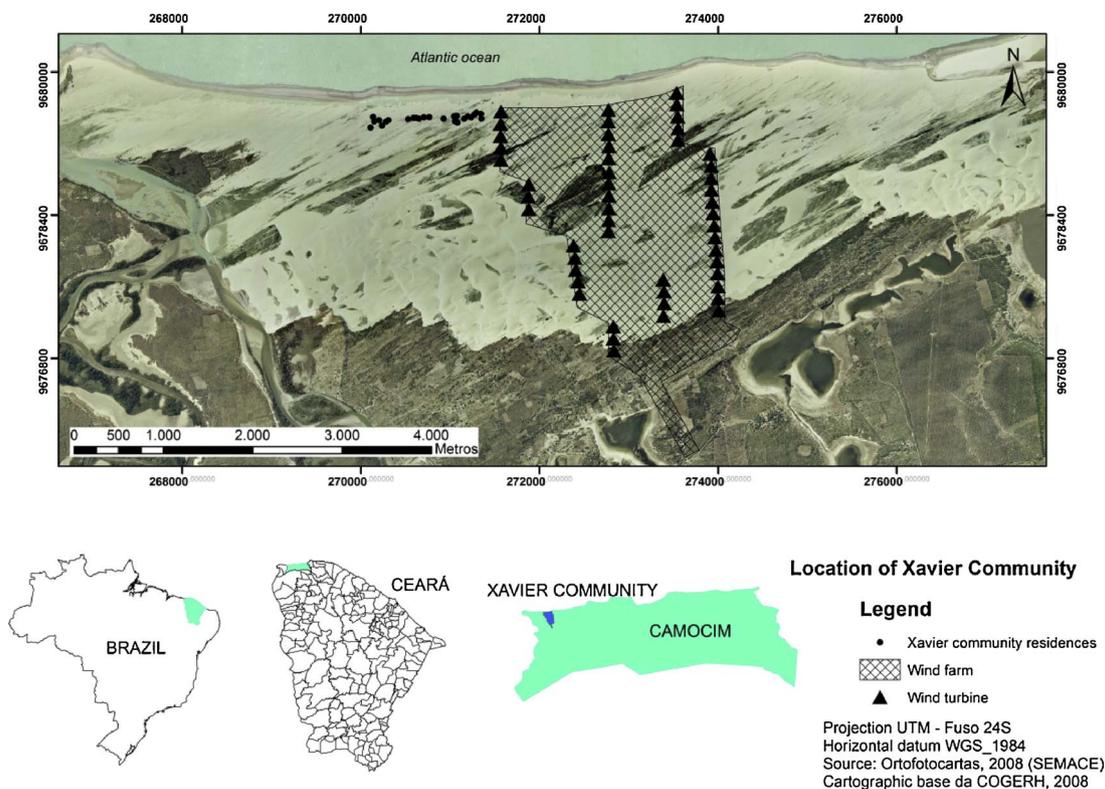


Fig. 1. Location of Xavier community in coastal Ceará state, Brazil.

making it difficult to understand how the map makers could have missed the Xavier community. Without the presence of people on the map, decision makers would observe no social impact that might have delayed licensing of the wind farm.

After cartographic erasure of Xavier, RAS documents created a new name for the site by describing the beach and dune area as “Praia Formosa,” or “Beautiful Beach.” Erasure removed the traditional name, “Praia de Xavier,” which is culturally accepted and socially widespread. State and municipal governments incorporated the name of the beach given by the project into official documents, completing the erasure of people to build a wind farm.

Compounding the problem of the erasure of the Xavier community is an attempt at re-inscription of ownership of the dunefield that would host the 50 wind turbines. *De jure* ownership of the dunefield was not

defined until construction of the wind farm, but use of the dunefield, and *de facto* ownership, by Xavier residents had occurred for at least three generations. A document entitled “Project Area” states that the dunefield is private property and secured by land lease between the company and a private land owner. By presenting state officials with evidence of a rental agreement, the RAS erases continuous occupation of the dunefield for more than three generations by the Xavier community. To a scrupulous analyst, existence of a land lease claim on a dunefield would indicate surreptitious privatization of a common resource and fraudulent transfer of land.

Among the many substantive errors in the map aiding erasure are the following: the number of interdunal lakes mapped does not correspond with the actual number of lakes; placement of the wind turbines bears no relation to the topography of the dunefield; no elevation

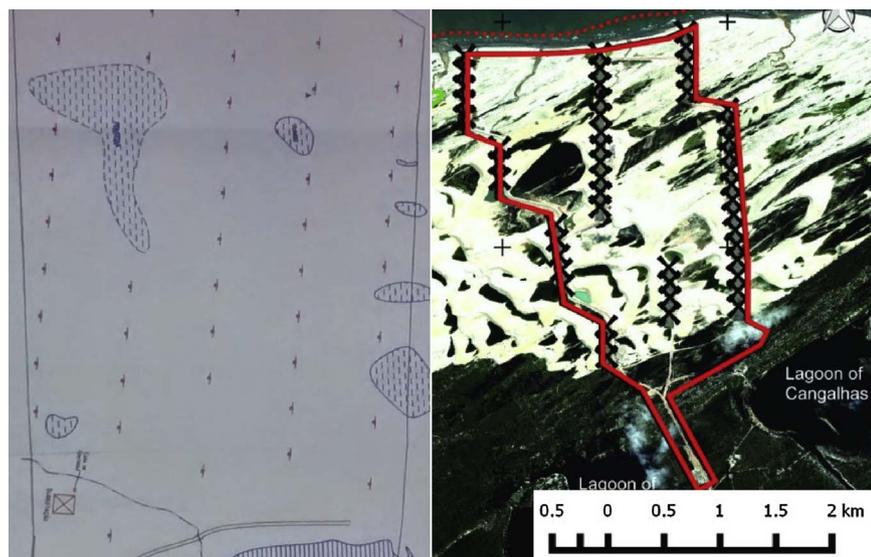


Fig. 2. Comparison between the map included in the Simplified Environmental Report (RAS) (left) and the turbines in the wind farm at Xavier Beach (right), Ceará, Brazil.



Fig. 3. Houses in Xavier are approximately 200 m from the nearest wind turbine. (source: co-author, Aug. 2015).

contours are present; the number of turbines indicated does not correspond to the number of turbines erected; the actual wind farm area is nearly double the area mapped in the RAS. These omissions seem designed to speed approval processes, but their effect was to erase presence of community access to the dunefield.

Moreover, the narrative within the RAS contains numerous errors suggesting a formulaic process with little attention to actual conditions. Among the more important are the following: the wind-farm site is characterized by flat relief suitable for construction, when in fact dunes reach 60 m in height and federal law offers significant restrictions on this type of site; “existing infrastructure” includes a state highway that is 300 km distant from Xavier; the Xavier toponym is absent and the text mentions that the only “significant community in existence is Amarelas [emphasis added],” which is 1.4 km distant from the Xavier community and has a total estimated population of 650 people.

Municipal authorities produced documents included in the RAS that supported cartographic erasure, suggesting elites were complicit with erasure. In a one-sentence document dated July 2002, the Camocim municipality declared to SEMACE that the wind farm construction request complied with municipal land-use planning ordinances; however, this statement ignored some municipal ordinances, creatively interpreted land-use categories, and failed to mention some obvious aspects of wind-farm construction. The municipal document also indicated that the site of the wind farm was “Praia Formosa,” thus helping formalize cartographic erasure of the Xavier community. Later, the state made this new toponym official with the highway sign indicating “Praia Formosa” by 2011 (Fig. 4) and by issuing tourist maps with this new toponym.



Fig. 4. Highway sign erected by the state government of Ceará with the toponym “Praia Formosa,” erasing “Praia Xavier”. (Source: first author, October 2011).

In addition to attracting wind farms to coastal sites and convincing state authorities to approve licenses, erasure played a major role in fomenting community opposition to the wind farm. One respondent to our interview protocol said, “I saw their map, showing that no one lived here, that it’s abandoned land,” creating a feeling of powerlessness. Another respondent recalled that “they named it Praia Formosa, as if no one lived here. So I said to them [wind farm representative], ‘I know you’re not blind and you can see houses and people here. How can you drive and fly past us without knowing that we live here?’ They could have talked to us, but we ended up in the courts,” a reference to negotiation with judicial authorities that resulted in a mitigation measure we discuss below.

4.2. Mitigation policies

Legal challenges involving community leaders, a representative of a Catholic Church-linked organization, and the public prosecutor (*Ministério Público*) forced three modest concessions by the wind farm: (1) guaranteed right of passage through the wind farm for vehicles transporting children from Xavier to school; (2) offering short programs aimed at women and children; (3) allowing passage of an electricity line to reach Xavier, as the community lacked electricity until after the wind farm was constructed. For a brief period, the wind farm sent representatives to enhance community acceptance, showing movies to the community and offering presents during Mother’s Day, Father’s Day, and Children’s Day.

However, many community residents were unsatisfied with the ability of these policies to mitigate negative impacts, which included food insecurity resulting from loss of interdunal lakes, a source of fish. The wind farm and Xavier’s community association negotiated an agreement, overseen by the *Ministério Público*, in which the wind farm would “donate” R\$540,000 (approximately US\$130,000) in 2013 to the Xavier community association for the construction of 22 brick houses, one per family.

The use of housing as mitigation policy in Xavier was the first recorded in Ceará. (In Bahia state, wind firms have relocated families living within 300 m of a wind turbine or related infrastructure, paying a one-time fee for the house and building a new house for dislocated residents.) Brick houses, considered a dream among residents, were intended to replace their wattle-and-daub houses made of locally sourced materials. The community association, comprised of fishermen who rarely sold their fish to outsiders, was suddenly responsible for building nearly two dozen houses in a location that had no commerce, no piped water, and no access road.

By 2015, 22 brick houses with basic facilities had been constructed (Fig. 5) in addition to a community center with refrigerators.



Fig. 5. Brick houses under construction in the Xavier community, Brazil. (Source: third coauthor, 2014).

Insufficient funds remained to paint the houses and to perform a basic audit of expenses. Dissent within the community started when the community debated the size or layout of each house, the construction material, the type of doors, and whether funds should support construction of a community center.

Distrust among residents increased regarding the Church-linked aid worker who oversaw construction, while the arrival of outside construction workers created mutual mistrust in the community. Small thefts, unheard of before mitigation, exacerbated mistrust. At the same time, conflicts between and among neighbors emerged, leading to the formation of a group opposed to the leadership of the association that had brokered the mitigation deal. Arguments between related residents were observed, along with accusations of theft and even death threats. Mistrust among residents and workers continued after completion of the houses, leading to a generalized atmosphere of fear and mistrust among families, eroding the relatively high social cohesion that helped leaders secure mitigation policies.

One specific example of indirect results we observed is that some residents began to argue in favor of land privatization. For example, some residents said, “Now that I have brick house I want to sell the land with the wattle-and-daub house.” This sentiment is known to open the way for land sales to outsiders, which is likely to initiate a process observed many times in coastal Ceará: land speculation, construction of large resorts, loss of traditional community values, the permanent migration of young people to peripheral settlements in the state capital, Fortaleza, and the relocation of older residents to far from the shoreline, such as sites behind dunes or near mangroves, which are valued less than beachfront land. This process of change also includes the abandonment of traditional fishing activities, proliferation of illicit drug use, and spread of child prostitution. Poor government planning, high social exclusion and unemployment, poor housing, and low educational attainment place children and adolescents at higher risk of prostitution and drug use [40]. Since 1990, Ceará and other states in northeastern Brazil have been included in international sexual tourism [41], which is observed daily in many coastal communities in Ceará and in the state capital, Fortaleza. Sexual tourism has been a recurring worry among community leaders in fishing villages, including Xavier. In Canoa Quebrada, for example, a coastal city 150 km east of Fortaleza, Schärer [42] showed high concern among residents about increasing crime, drug use, and prostitution after the increase in tourism and arrival of visitors, especially foreign tourists. A similar situation exists in Jericoacoara, a beach 50 km west of Xavier, where Molina [43] attributed increased prostitution and drug use to an increase in domestic and international visitors, especially “crack”.

Other respondents viewed the new housing as a weak attempt to resolve a much deeper problem. One resident admitted that “the [new] houses are good, but they [wind farm] didn’t do it because they wanted to; they did it because of the courts,” referring to the involvement of the Ministério Público. Another respondent said, “the company recognized its errors and gave us money for these little houses, but one house does not come close to what they did and continue doing,” a reference to destruction of the dunes and burial of interdunal lakes, which removed a source of fishing to residents and created food insecurity.

Another indirect result of mitigation was the political collapse of community interest in developing a federal extractive reserve, known by its Portuguese acronym as RESEX. Creation of RESEX has long been a preferred means to protect traditional communities in Brazil from external threats [44]. However, after housing construction enough families were content with their houses that political momentum for RESEX evaporated with increased distrust and acrimony in the community.

5. Discussion

The Xavier case is not unique; most wind farms in Ceará are located in coastal environments, where it is common to observe traditional

communities who are opposed to wind farms. Major complaints include deforestation, burial of natural lakes, and dune destruction. Social impacts include reduced area for fishing and farming, impeded access to dunes, and blocked access, all of which reduced subsistence activities, created additional isolation, and encouraged inter-community conflicts [45–47,33].

Local elites control bureaucratic processes in the “decide-announce-defend” model, representing a new factor in producing the “social gap” [11,12] elsewhere in Brazil and the global South. Local elites and consultancies may support wind farms, but they may use dubious and opaque methods to acquire land that reproduce or magnify economic and power inequalities. The action of local elites represents a new factor in considering the production of procedural and distributive injustices, as elites control the licensing process and land usurpation creates benefit flows back to elites, rather than to affected communities who live near wind farms. Previous work has considered procedural and distributive justice as mediated by state and wind power firms [27,29]. Our findings highlight local elites as a particular type of social actor working within the licensing process with ability to magnify procedural and distributive injustices. In Ceará, licensing relies on a specific procedure, the RAS, which allows for fraudulent practices to become normalized under the guise of an apparently neutral and objective bureaucratic process. Our finding that the mitigation measure leads to negative indirect consequences recalls Simcock’s [28] finding regarding the multiple meanings of procedural justice. In the case of Xavier, housing construction was pursued as mitigation or attending to distributive justice issues, but community members are divided over the meaning of housing as mitigation.

Implementing the “decide-announce-defend” siting policy in locations where land tenure is insecure may create conflict between renewable energy projects and nearby resource users. This siting model offers no opportunity for affected people to respond and may produce negative social results that impair future expansion of renewable energy projects. If states and renewable power firms target locations of insecure land tenure in developing countries for renewable power projects, then the fossil-to-renewable energy transition will create numerous social and political problems that could be used politically by groups and individuals opposed to renewable power. The land question may emerge as the major social and political obstacle to renewable power expansion in developing countries, fulfilling predictions of a global land rush producing social conflicts in the global South [21,22]. Firms, states, and communities must find mutually beneficial solutions through well established institutions such as royalties and rents that are acceptable in social, legal, and political terms to all parties [33].

In summary, local elites work through consulting firms and municipal offices, playing a previously hidden role in producing the land leases, approvals, and authorizations necessary for higher-up authorities to license large wind farms. Local elites are highly influential in encouraging and facilitating the abuses of the wind-power sector. It is not known whether investors in wind power realize that local elites make fallacious and erroneous claims in name of renewable power. Mitigation policies may have the intent of offering compensation for negative impacts, but they may decrease community cohesion.

6. Conclusions

Local elites used cartographic and physical erasure to make people and resources invisible, producing licensing approval for one of Brazil’s largest wind farms. A well meaning mitigation policy had unintended negative consequences, suggesting the need to consider more carefully how communities are compensated for negative impacts. This case study shows the type of problems that have occurred from wind-power policies in northeastern Brazil, highlighting issues relating to lack of secure land tenure in coastal communities for traditional communities and the fragility of judicial systems to guarantee the rights of residents of these communities.

Community-owned wind power, a possible solution to conflicts, is a distance prospect in Brazil because communities possess meager financial resources and national policy favors large firms. Several policies and practices short of wind farm ownership change could reduce conflict relating to wind power in Ceará and other areas in developing countries. Establishment of legal tools to regulate wind-farm development in state and municipal scales, especially updating municipal zoning ordinances, would provide opportunity for affected residents to express concerns. Environmental impact studies based on principles of public dissemination and participation would better communicate renewable-energy project information to community members. The creation of permanent education policies and promotion of best practices for communities would increase trust between wind firms and affected residents. Finally, transparent zoning process, which would identify areas in which renewable-energy projects are most compatible with human settlements and resource uses, could avoid conflicts before they emerge. These policies and practices may help wind farms achieve both community acceptance and profitability, but they may need to bypass local elites who may use wind power to pursue aims contradictory to the goals of firms that build, maintain, and invest in wind farms.

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