
Wind energy and development: A socioeconomic analysis of wind farms in the Alto Sertão region of Bahia

Energía eólica y desarrollo: Un análisis socioeconómico de los parques eólicos en la Región del Alto Sertão de Bahía

Energia eólica e desenvolvimento: Uma análise socioeconômica dos parques eólicos no Alto Sertão Baiano

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Resumo

O presente estudo aborda a implantação de parques eólicos na região do Alto Sertão baiano, destacando as relações socioeconômicas decorrentes desses empreendimentos para os municípios da região. O objetivo é analisar os impactos econômicos gerados pelos parques e a relação desses empreendimentos com as comunidades rurais locais. Para isso, a pesquisa adota uma abordagem articulando técnicas quantitativas, por meio da análise de dados sobre os aspectos socioeconômicos dos municípios e qualitativas, visando captar subjetivamente os efeitos desse processo. Os resultados preliminares indicam que os ganhos econômicos associados à energia eólica se concentram em municípios mais estruturados, enquanto áreas de base agrícola permanecem marginalizadas. As conclusões são parciais, mas evidenciam a necessidade de uma análise crítica sobre o modelo de desenvolvimento associado à energia renovável no Brasil.

Palavras-chave: Neoextrativismo; energia eólica; Alto Sertão da Bahia.

Abstract

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This study addresses the implementation of wind farms in the Alto Sertão region of Bahia, highlighting the socioeconomic relationships resulting from these projects for the region's municipalities. The objective is to analyze the economic impacts generated by the parks and their relationship with local rural communities. To this end, the research adopts an approach combining quantitative techniques, through the analysis of data on the socioeconomic aspects of the municipalities, and qualitative techniques, aiming to subjectively capture the effects of this process. Preliminary results indicate that the economic gains associated with wind energy are concentrated in more structured municipalities, while agriculturally based areas remain marginalized. The conclusions are partial, but they highlight the need for a critical analysis of the development model associated with renewable energy in Brazil.

Keywords: Neo-extractivism; wind energy; Alto Sertão Region of Bahia.

Resumen

Este estudio aborda la implementación de parques eólicos en la región del Alto Sertão de Bahía, destacando las relaciones socioeconómicas derivadas de estos proyectos para los municipios de la región. El objetivo es analizar los impactos económicos generados por los parques y su relación con las comunidades rurales locales. Para ello, la investigación adopta un enfoque que combina técnicas cuantitativas, mediante el análisis de datos sobre los aspectos socioeconómicos de los municipios, y técnicas cualitativas, con el objetivo de capturar subjetivamente los efectos de este proceso. Los resultados preliminares indican que las ganancias económicas asociadas a la energía eólica se concentran en los municipios más estructurados, mientras que las zonas agrícolas permanecen marginadas. Las conclusiones son parciales, pero resaltan la necesidad de un análisis crítico del modelo de desarrollo asociado a las energías renovables en Brasil.

Palabras clave: Neoextractivismo; energía eólica; Región del Alto Sertão de Bahía.

Introduction

Over the last decade, wind energy has emerged as one of the main renewable energy alternatives in Brazil, standing out for its sustainable potential and low direct environmental impact. This movement has intensified especially in the Brazilian Northeast, where natural conditions—constant winds, flat terrain, and extensive sparsely populated areas—have made the region a strategic hub for the expansion of wind farms. Bahia, in particular, has occupied a prominent place in

this scenario, with the installation of numerous projects aimed at harnessing wind power.

However, this energy transition, although anchored in discourses of sustainability and progress, does not occur neutrally or without compromise with the historical logic of uneven development that marks the relations between the global center and periphery. The installation of wind farms in the Alto Sertão region of Bahia, a region characterized by semiarid climate conditions, predominance of subsistence agriculture, and structural socioeconomic fragility, has triggered profound transformations in the ways of life and social organization of rural communities. Through a critical analysis of neo-extractivism and the so-called "Decarbonization Consensus" (Svampa and Bringel, 2020), I highlight that wind energy projects in Brazil, despite their sustainability goals, ultimately reproduce practices of land grabbing, property concentration, and economic dependence that, throughout history, have primarily impacted the country's poorest regions. Although wind energy is environmentally clean, it is also part of a process of commodification of common resources, such as land and wind itself, transforming these goods into economic assets for transnational corporations and often bringing uncertain benefits to local communities.

This work, based on fragments of my master's dissertation, seeks to analyze the socioeconomic impacts generated by wind projects in the Alto Sertão region of Bahia, using a mixed-method approach that combines documentary analysis and multivariate statistics. By analyzing the consequences of the so-called "eolization" of the Northeast, we aim to understand how development discourses are articulated with practices that, in reality, often deepen inequalities, make traditional ways of life precarious, and reshape territorial dynamics according to market interests.

Methodological Aspects

To broadly and in-depth understand the effects of wind farms on the socioeconomic development of municipalities in the Alto Sertão region of Bahia, this study adopts a mixed-methods approach, combining quantitative and qualitative strategies. This methodological approach is based on the understanding that the complexity of the object of study—which involves economic, social, territorial, and symbolic transformations—cannot be fully captured by a single technique or analytical dimension.

The mixed-methods approach allows us to capture both the structural and measurable patterns of the phenomenon (through the analysis of socioeconomic indicators) and the subjective and lived experiences of the populations directly affected by the projects. As argued by Creswell (2010) and Paranhos et al. (2016), mixed-methods combine the potential of qualitative and quantitative approaches, increasing the analytical robustness of the study and enabling methodological triangulation that enriches the understanding of social phenomena. The research is divided into three main stages: documentary analysis, focusing on the construction and dissemination of public and private discourse surrounding the installation of wind farms. News reports, institutional reports, and documents from government agencies and companies were examined, particularly between 2010 and 2015—a period of expansion of wind farms in the state of Bahia. Principal Component Analysis (PCA), a multivariate statistical technique, was applied to a database based on socioeconomic indicators from the 18 municipalities of the Alto Sertão region of Bahia. This stage aimed to identify development patterns, territorial groupings, and correlations between variables associated with the presence or absence of wind farm installations in different municipalities. The final stage will be a case study, which, through ethnography and semi-structured interviews conducted in the territory, seeks to identify the subjective aspects related to the installation of wind farms and the daily lives of those who occupy these social spaces. These stages are integrated sequentially and complementary, with

documentary data helping to contextualize the progress of the projects. PCA allows for mapping impacts on a regional scale, while case studies provide a localized and subjective perspective on the transformations that have occurred. This methodological articulation strengthens the analysis by cross-referencing different types of evidence, revealing both hegemonic discourses and the contradictions and asymmetries that characterize the reality of communities in the Alto Sertão region of Bahia.

Some advances in research and data production

This research is planned based on three complementary methodological stages, each with specific objectives and distinct analytical functions. These stages were designed to allow a multi-scale perspective on the impacts of wind farms, from public discourse to the concrete effects on the lives of local populations.

Document analysis

The first stage of the research consisted of a documentary analysis of news reports produced between 2010 and 2015, a period of significant wind farm expansion in Bahia. The objective was to understand how the legitimizing discourses of these projects were constructed and disseminated by key actors in the relationship between projects and territory—the state, companies, the media, political leaders, and the local population.

Fifteen articles published in national, state, and local news portals, as well as institutional documents, were selected. The analysis revealed that economic arguments—such as job creation, increased municipal revenue, and land appreciation—were predominant. Environmental, social, and cultural issues appeared marginally, often reduced to or tied to the false discourse of sustainability.

Three discursive axes stood out: (i) the state discourse, focused on promoting "development" and attracting investment; (ii) the business discourse, focused on the efficiency and profitability of projects; and (iii) the local discourse, focused primarily on economic growth expectations, without emphasizing the long-term impacts. The promises associated with clean energy were widely publicized, with a positive trend prevailing across all sectors of the projects in the areas where they are located.

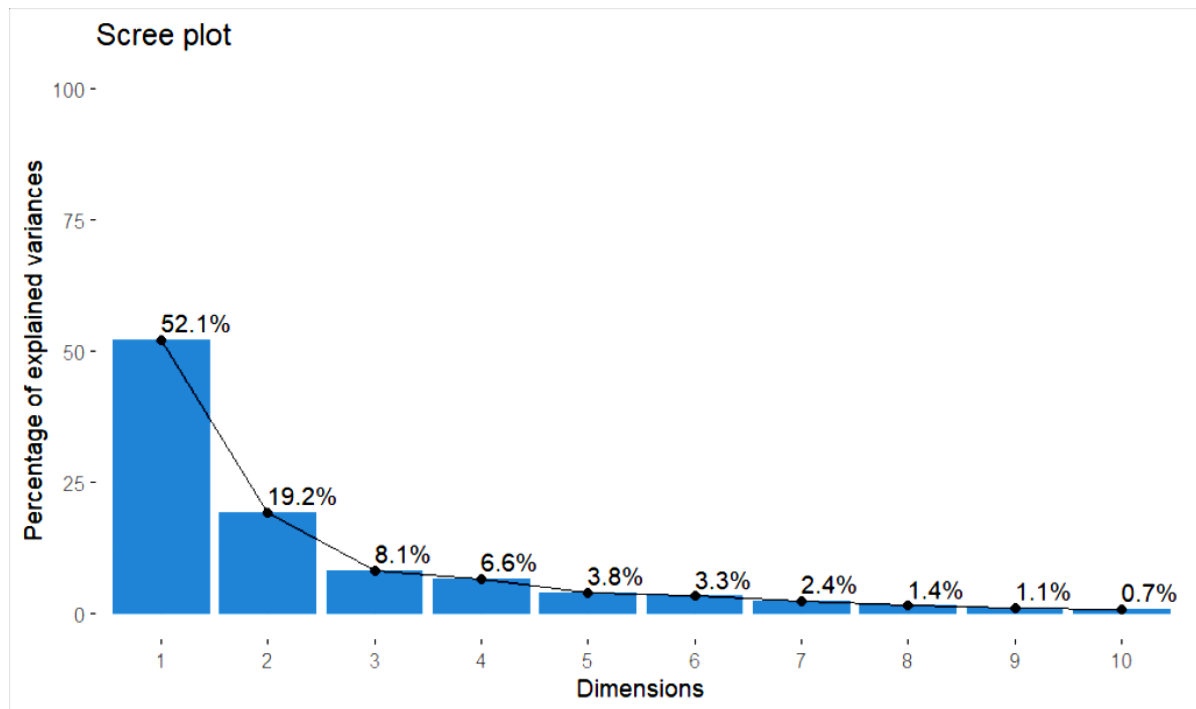
Principal Component Analysis (PCA)

The second stage involved applying Principal Component Analysis (PCA) to a database compiled from economic, social, and demographic indicators, as well as data related to wind farm projects, all related to the 18 municipalities that comprise the Alto Sertão region of Bahia. The 38 variables present in the database were used to measure the main differences between municipalities that have installed wind farms and those without, with the aim of demarcating the economic factors present in the territory and identifying concrete changes within the territory, using the inclusion of wind farm projects as a parameter.

The total variance of the database was identified in the three main Principal Components, according to the analysis performed in RStudio 2024, a tool that combines a programming language called R with an environment for statistical analysis and graphing, widely used for working with data. The first component (CP1), which accounts for 52.1% of the variance, is related to economic and population indicators, such as GDP, municipal budget, population size, and employment levels. Municipalities such as Caetité and Guanambi stood out for presenting high values in these variables. The second component (CP2), accounting for 19.2%, is linked to the presence of wind farms, industrial growth, and GDP growth. Municipalities such as Igaporã, Pindaí, and Licínio de Almeida stand out in

this category. Finally, the third component (CP3), which explains 8.05% of the variance, is related to rural aspects, such as family farming and the rural population.

Graph 1 - Total variance of data for municipalities in the Alto Sertão region of Bahia



Source: prepared by the author 2025.

According to the results, municipalities that received wind farms, such as Caetité, Igaporã, Pindaí, and Licínio de Almeida, showed high values in variables related to economic activity and the presence of enterprises. The observed changes indicate an increase in economic dynamism in these regions, especially in the variables that stood out most in PC2: number of wind farms (with a correlation of 0.784), authorized power in kW (0.760), variation in industrial activity (0.811), and variation in GDP (0.723). Furthermore, some of these municipalities also stood out in PC1, which is related to urban population growth and municipal budget. This analysis observed a strong negative correlation—approximately -0.955 to -0.966 —between the total population in 2010 and 2011, the municipal budget for 2010 and 2016, and the 2019 GDP.

The municipalities of Matina, Iuiú, Malhada, Lagoa Real, and Rio do Antônio are examples of areas that did not receive wind energy investments and have different characteristics from those that did. The PCA data show that these municipalities have a strong rural presence and more traditional agriculture. There is a clear correlation with the CP3, which measures the rural population in 2010 (with a value of -0.567) and in 2022 (-0.605), as well as the variation in the rural population (-0.548) and the area planted to corn (0.437).

During the implementation of the wind farms, the municipalities that received wind farm installations experienced significant economic growth. The data revealed increased tax collection, targeted investments, and improvements in industrial and budgetary indicators. However, the ACP also highlights that these benefits were more evident in more developed and urbanized cities, such as Caetitê and Guanambi. Municipalities without existing projects, however, relied heavily on family farming and did not experience significant improvements in the socioeconomic indicators analyzed. These municipalities did not experience any economic influence or benefits related to wind farms.

Table 1 - Comparison of municipalities in the Alto Sertão Baiano region

Indicators/Dimensions	Municipalities with parks	Municipalities without parks
GDP and variation in industrial activity	High	Stagnant
Number of enterprises and installed capacity	High	Absent
Urban population and municipal budget	Growing	Stable or declining
Rural population and agricultural dependence	Reduced/less focus	High
Insertion into the wind power model	High	Marginal or non-existent

Source: prepared by the author 2025.

Articulation of findings with literature mobilized for research

By applying the data collected so far to the theoretical framework chosen for the research, it was possible to critically analyze the changes that wind farms have promoted in the studied region.

The installation of wind farms in the Alto Sertão region of Bahia follows a logic of green neo-extractivism, as explained by Svampa (2018). This demonstrates how Latin America, which has historically been subordinated to the dynamics of exploitation, continues to be seen as a supplier of natural resources to meet the demands of global capital. What we call the "Decarbonization Consensus" actually merely reorganizes patterns of domination, without breaking with the old center-periphery logic. In practice, this is evident in the way economic benefits are distributed: selectively, with less participation from local communities, while environmental, economic, and cultural impacts end up being considered secondary. Polanyi (2000) uses the concept of fictitious commodities to address the changes brought about by the capitalist market over the centuries. In his analysis, fundamental elements of life—labor, land, and money—are transformed into commodities for market purposes. In this sense, beyond land use, we also have wind, which, although not directly tradable, is appropriated as an exclusive economic resource by companies, becoming a speculative object. Both the documentary analysis and the PCA demonstrate that commodification generates a disruption in traditional forms of land use, jeopardizing ways of life based on family farming and the community's relationship with space.

Finally, in the documentary analysis, discourses of sustainability, innovation, and clean energy were mobilized to legitimize these ventures, a phenomenon that can be interpreted in light of the concept of Boltanski and Chiapello (2009), who address in "The New Spirit of Capitalism" the capacity of capitalism to incorporate social critiques, transforming them into new moral guises favorable to its functioning. The "Decarbonization Consensus" is a critique of the development model based on the use of fossil fuels, repositioning the exploitation of natural

resources through the use of now renewable resources. Wind companies operate under a logic of morally justified accumulation, while at the same time perpetuating inequalities and reconfiguring forms of domination in territories.

Final Considerations

The documentary analysis revealed the prevalence of a developmentalist discourse centered on economic promotion, with promises of job creation, land appreciation, and regional growth. However, this discourse proved limited in addressing the economic, social, cultural, and environmental impacts generated by these projects.

Principal Component Analysis (PCA) helped identify clusters and patterns among the municipalities analyzed, revealing that the positive effects of wind farm installation—when they exist—tend to be concentrated in areas that are already more economically structured. On the other hand, municipalities with greater rurality and an agricultural base remained marginalized from the main economic transformations, indicating an uneven distribution of the promised benefits. The articulation of these findings with the adopted theoretical frameworks—especially the concepts of land commodification (Polanyi, 2000), the ideological legitimization of green capitalism (Boltanski and Chiapello, 2009), and green neo-extractivism (Svampa, 2018)—supports the hypothesis that wind energy projects in Northeast Brazil, although promoted under the justification of sustainability, reproduce logics of economic and territorial subordination that have historically marked the peripheries of global capitalism.

It is important to emphasize that these are partial conclusions, based on the already completed stages of the research. Continuing the research through the application of the case study in the municipalities of the Alto Sertão region of Bahia and, consequently, the development of the dissertation will be essential to broaden

the understanding of local dynamics and the specificities found in the relationship between communities and wind farms.

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Data availability:

Research data is available in the body of the article

