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COMPENSATIONS AND ENERGY JUSTICE IN THE CONTEXT OF GREEN HYDROGEN: REFLECTIONS FROM THE AUSTRAL SOUTH

Summary

Developing solar and wind megaprojects has faced resistance from local communities due to their socio-environmental impacts and the included compensations being perceived as unfair. This study analyzes the challenges of compensatory measures from an energy justice perspective, taking the Chilean wind farms as a case, emphasizing the Magallanes region as a pilot territory for developing the green hydrogen industry. For this purpose, we used the review of Environmental Impact Studies, semi-structured interviews, and focus groups with key stakeholders in the energy sector. The results reveal a low presence of socio-economic compensations, an incipient early relationship with communities, low community participation in decision-making and monitoring of compensations, as well as limited State mediation in the associated conflicts. These findings invite a reflection on the need for frameworks that promote fairer and more sustainable socio-economic compensations.

Keywords: Compensatory measures, fair energy transition, distributive justice, procedural justice, recognition justice

1. Introduction

The climate crisis has prompted the development of different low-carbon energy solutions, one of which is the generation of electricity from wind turbines. As a result, wind projects have grown at an annual rate of 15% from 2020 to 2024 worldwide (World Wind Energy Association (WWEA), 2024). These projects, however, have faced challenges in terms of social acceptance in the local communities (Avila, 2018; Intergovernmental Panel on Climate Change (IPCC), 2023; Kluskens et al., 2019). These challenges are mainly due to the residual impacts generated by wind megaprojects and the implementation of compensations without distributing costs and benefits that are considered equitable by the different affected stakeholders (Kluskens et al., 2019; Mueller and Brooks, 2020). An example of the latter is the compensation concentration at the ecosystem level (restoration, conservation, or other), while socio-economic measures associated with negative externalities affecting local communities are often left out (Cole, 2011).

In the case of Latin America, Swennenhuis et al. (2018) warn that many compensation measures have been insufficient, as they do not address the power structures, therefore, perpetuating the existing social exclusion. In addition, local communities have perceived the benefits of wind projects as limited, especially in terms of employment generation and economic development (Aldieri et al., 2020; Fabra et al., 2023; Silva et al., 2023). This scenario has turned opposition to these projects into a key challenge for moving towards a more sustainable and just energy transition.

Chile plays a strategic role in the energy transition due to its abundant availability of renewable energy sources, such as solar radiation in the north and strong winds in the south (Ministerio de Energía, 2020). In the Austral South, Magallanes has the most significant wind potential in the area, estimated at 59.000 MW (Servicio de Evaluación Ambiental (SEA), 2020). This corresponds to about 12 times the installed wind power capacity in Chile, equivalent to 5.000 MW, representing 14.3% of the total of the National Electric System (Coordinador Eléctrico Nacional, 2025). The abundance of wind resources and the geographic location of Magallanes has made it a key region for producing green hydrogen and its derivatives, such as green ammonia (NH₃V), methanol, and synthetic fuels.

Magallanes has 15 wind projects for H2V under feasibility analysis, study, or environmental assessment phase (SEIA, 2024; Vukasovic et al., 2023). These projects could potentially face local obstacles toward their approval and sustainable development, given that there is already enough evidence showing that the local community has not been adequately informed or consulted (Panel H2 Magallanes, n.d.). For this reason, the goal of this study is to analyze the challenges of compensatory measures in wind projects from a distributive, procedural, and recognition justice perspective. This is a special focus on the region of Magallanes, Chile, as a pilot territory for the developing green hydrogen, which allows to explore different alternatives for designing fairer compensations that contribute to reducing socio-environmental conflicts and greater social acceptance of these projects.

2. Methodology

A descriptive methodology based on secondary and primary data was used to identify and analyze the main challenges and opportunities for energy justice in compensatory wind farm measures for the H2V industry. Secondary data were obtained by collecting different existing regulations and public policies, technical reports, environmental impact studies (EIA) of wind farms, and academic studies available on government websites and databases of articles from international journals, such as ScienceDirect and Web of Science.¹

Primary data were collected through semi-structured interviews and a focus group with key stakeholders to explore their perceptions and opinions regarding the main issue under study. The interviews were conducted between August and October 2024. They contained nine open questions on seven topics: (1) general knowledge of compensation measures, (2) dimensions of compensation measures, (3) regulatory and normative framework, (4) role of key stakeholders, (5) investment resources and tax system, (6) technology and innovation, and (7) future projections. The focus group dynamics aimed to answer and discuss two key questions: (1) What strategies and actions would you recommend adapting or improving with respect to compensation measures in the country?, and (2) What challenges and opportunities do you perceive regarding the contribution of wind farms to social development, environmental protection, and economic benefits for the Magallanes region?

The obtained data were qualitatively analyzed by content analysis with the open coding method (Erlingsson and Brysiewicz, 2017) using QDA Miner Lite software, version 3.0.7 (Provalis Research, 2024).

3. Results

In general, the interviewees highlighted several recognition, procedural, and distributive justice aspects in the compensatory measures of wind projects associated with the H2V industry and its derivatives. These aspects are then analyzed from the environmental and socio-economic dimensions.

Environmental compensations in the wind projects under study are mandatory because they have significant impacts and include reforestation, soil improvement, and the creation of refuges or improved habitats for birdlife affected by the wind turbines and the transmission grids. In this process, recognition justice includes considering the perspective of all stakeholders in the local socio-ecosystem (from indigenous communities to research institutions). Procedural justice advocates community inclusion in the implementation, monitoring, and maintenance of affected species, as well as the registration, distribution, and free and democratic access to the information generated. In the case of distributive justice, the direct relationship between compensation and the impact produced was emphasized in terms of the impact's typology, dimension, and location. The importance of clustering or associating compensation was added to avoid its atomization in the territory.

Six relevant points were included among the common or mandatory socio-economic compensations in the projects under study: negative easements and land revaluation, advanced human capital formation, incentives for entrepreneurship and local markets, creation of green spaces and support for tourism, improvement of logistical infrastructure, and finally, archaeological study plans. It was advocated that the State mediate to ensure that negative easements are not carried out under threat or pressure by establishing the obligatory nature of social compensation, which guarantees that the local communities affected in terms of access to their natural resources receive proportional benefits. The importance of funds and projects for training, sustainable enterprises, associativity, and cooperativism was also highlighted.

In addition, voluntary compensations or other contributions to the territory for energy justice were included

¹ Keywords used in the search for information were: “compensatory measures,” “energy justice,” “recognition justice,” “procedural justice,” “distributive justice,” “wind farms,” and “green hydrogen projects.”

mainly in the socio-economic area and consider improvements in education, health, sports, and culture; support for food sovereignty; contracting of local services; strengthening of local governance; reduction of energy poverty; and other economic benefits such as co-ownership, direct payments, funds, and taxes. These measures are linked to the recognition of the various representatives of the community and the urban and rural productive sectors. Public-private partnerships were highlighted to improve infrastructure and public services; the mandatory - whenever possible - use of local labor guaranteeing wage equity; and the accessibility to quality and low-cost energy to promote the local community's sustainable development.

4. Conclusions

The study's findings show the need for implementing regulations promoting fairer socio-economic compensation and contributions to developing the territory that hosts renewable energy megaprojects. Establishing minimum criteria and protocols for early engagement with the local community is also essential. In this process, the State should be involved, acting as a mediator to reduce conflicts, promote more equitable and fairer approaches, and establish formal agreements and measures that promote recognition, procedural, and distributive justice. Greater local government action and management of compensation for the development of the area could be promoted by deploying fiscal decentralization and reducing bureaucracies in Chile.

One limitation of this study is to focus the energy justice aspects of the analysis on compensatory measures. Therefore, new studies must consider aspects of energy justice in mitigation and remediation measures. Likewise, it is key to analyze it in photovoltaic projects, considering its relevance in the energy transition process and the H2V industry.

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