

Challenges faced by Independent System Operators with the integration of renewable energy sources: a case study for the Brazilian Energy Sector

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Overview

The integration of renewable energy sources into the grid presents several challenges for Independent System Operators (ISOs) worldwide. As the demand for clean energy increases, ISOs are facing the need to adapt to a new energy landscape that is characterized by higher variability, uncertainty, and complexity. In this article, we will examine the specific challenges that ISOs in the world are facing as they integrate renewable energy sources into the grid and discuss the particularities for the Brazilian energy sector, presenting lessons learned and future recommendations. We will explore how the ISOs are responding to these challenges, the impact on the energy sector, and the potential solutions that can help ensure the long-term sustainability of the transmission process. The article proposes a competitive capacity procedure as a solution, emphasizing transparency, predictability, and efficiency in the interconnection process. By understanding and addressing these challenges, the article aims to contribute to the long-term sustainability of the transmission process in the context of renewable energy integration, and gain insights that are relevant to other countries facing similar challenges in integrating renewable energy sources into their grid systems.

Methods

The research method employed involves a diagnostic analysis of international benchmarks, highlighting best practices and innovative solutions from countries such as the United States (CAISO and PJM), the United Kingdom (National Grid), and Australia (AEMO).

Results

The article brings forth several key results regarding the challenges faced by Independent System Operators with the integration of renewable energy sources, specifically in the Brazilian Energy Sector:

1. The need for an innovative approach tailored to Brazil's unique characteristics, such as its vast territorial expanse and complex transmission system.
2. The proposal of a competitive capacity procedure, including participation deposits by generators, to ensure more equitable and efficient access to the transmission network.
3. Emphasis on improving transparency, predictability, and mitigating speculation in the interconnection process.
4. The potential for the proposed model to serve as a reference for other countries facing similar challenges in incorporating renewable energies into their electrical systems.

These results highlight the importance of adapting strategies to address the specific challenges of integrating renewable energy sources into the grid, with a focus on enhancing efficiency, fairness, and sustainability in the transmission process.

Conclusions

This article highlights that integrating renewable energy sources into the Brazilian electrical system requires an innovative approach tailored to its unique characteristics. Given the country's vast territorial expanse and the complexity of its transmission system, there is a need to reformulate the interconnection process to accommodate the growth of intermittent sources such as wind and solar. The proposed solution emphasizes the implementation of an auction procedure for connecting to transmission points. This "competitive capacity" method, which includes a participation deposit by generators, aims to ensure more equitable and efficient access to the transmission network. This approach seeks to improve transparency and predictability in the process, while mitigating speculation and optimizing the use of available transmission capacity. This proposed model could serve as a reference for other countries facing similar challenges in incorporating renewable energies into their electrical systems.

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