WIND GENERATION IN THE NORTHEAST BRAZILIAN SUBSYSTEM: CHALLENGES AND OPPORTUNITIES

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Overview

With the increasing demand for world energy, the impact generated by the insertion of the wind power source is substantial for the conservation of the electric system in a scenario of sustainable development, due to its characteristics of low environmental impact, however it is necessary to invest in technologies for better use of the winds, therefore increasing the capacity factor worldwide, because it is an unlimited source.
Brazil traditionally invests in low-cost renewable energies, such as hydroelectricity, but with the still unexplored potential of this source suffering increasing technical, socioeconomic and environmental limitations, began to meet the electric demand with the increasing use of thermoelectric plants, which increase the cost of energy. With the addition of more wind power in the system, it aims not only to cheapen electric power generation, but also to continue with an important characteristic of the country's electric power generation, which is the massive use of renewable and low environmental impact and greenhouse gas emissions.

The objective of this work is to present a historical review of wind farms in the world and in Brazil, with a main focus for the Northeast region. It also aims to draw a current panorama of wind generation in the northeast and its interaction with other sources and energy demands of the National Interconnected System. In addition, this work seeks to show the future prospects of wind generation in the Northeast, pointing out the direction of the expansion strategies of the offer based on the energy auctions already carried out and also the Decennial Energy Expansion Plan 2026.

Methods

The methodology used is an evaluation of the installed capacity and generation of energy sources in the Brazilian National Interconnected System and in the northeast subsystem, based on the data provided by the Brazilian National Electric System Operator.

Results

When considering the evolution of installed wind capacity in the National Interconnected System, it is possible to observe that it was from 2014 that this energy source became of economic importance, being evident the predominance of the Northeast subsystem, having remained above 80% of the total installed capacity since much of history. The shows the evolution of the installed capacity of the National Interconnected System, disaggregated by energy sources. From 2006 until now, we highlight the significant increase in thermal and wind participation, and the start of operation of the first photovoltaic plants in 2018.

In 2018, wind generation comprises about 10% of installed capacity, which has grown steadily since 2014. The share of thermal sources has remained constant at around 20% since the beginning of the increase in the share of wind power generation, thus causing a reduction of the relative share of hydroelectric plants in the installed capacity of the National Interconnected System. The installed hydraulic capacity remained constant during the analyzed period, but there were significant increases, first in the participation of thermoelectric plants and, later, in wind farms.
The prospects for the future are of an even greater increase in the participation of the wind power source and, probably, of the photovoltaic plants, making the thermal participation no longer so relevant.

This fact is important when it comes to controlling greenhouse gas emissions in power generation, but the variability and randomness of the generation of wind and solar sources becomes important as the safety of the subsystem's energy supply can be reduced when dependence on this type of source.

It is also possible to observe the complementarity between wind generation and hydroelectric generation in the northwest subsystem, a feature that can be well exploited in years of favorable hydrology, since the increase in wind generation in the dry months of the hydrological years may allow more water be preserved in the reservoirs of the

National Interconnected System and increase the reliability of the electricity generation, considering the gains provided by the integrated operation.

Conclusions

The increase in wind generation in the noroetes subsystem can modify the mean water storage curves in the reservoirs of the National Interconnected System, since there is the possibility of generation by this source just when the dry period of the hydrologic year occurs in the sudote subsystem.

In this way, the noroetes subsystem has the potential to become an energy exporter in the dry periods, provided that substantial increases in the transmission lines are observed for the short and medium term, which interconnect between the subsystems noroetes and sudoetes, mainly.

Wind power generation, despite having strong seasonality and randomness, can be used with all its potential in large energy systems, as is the case in Brazil, since the strong integration between sources and demands in the System National Interconnected has the potential to overcome these difficulties and even reduce the pressure on reservoirs, which should prioritize the public supply and the multiple uses of the water resource.

However, the strong dependence of wind generation on the northwest subsystem does not reduce its vulnerability in the wet periods of the hydrological years, especially when the water supply in this subsystem is affected by extreme drought events, since, in the long term average, the wind generation is lower in the wet months of the Brazilian hydrological year.

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