



MINISTÉRIO DE MINAS E ENERGIA  
SECRETARIA DE PLANEJAMENTO E DESENVOLVIMENTO ENERGÉTICO

# 2031

## TEN-YEAR ENERGY EXPANSION PLAN



# Introduction: Electric Power Generation and Transmission Chapters

PDE intends to anticipate discussions; assess how technological changes(?), economic, environmental and consumer preferences reflect on system needs and opportunities to expand the generation and transmission power system. To play this role, PDE has been working with the constant search for improving methods, criteria, and input data used in its models. In this sense, the state of the art of solutions under discussion in power systems around the world, advances in detailing candidate technologies for expansion, improvements in the representation of investment and operating costs in order to guide the studies of the expansion planning of the transmission and generation power system.

In summary, expansion planning is constantly at methodological evolution. The actual power systems operation of 2021 brought lessons that allowed progress in reducing the asymmetry between reality and its models. This is because the Brazilian electric power system went through new operational situations and glimpsed the possibility of the occurrence of others, which were not experienced thanks to the reversal of rainfall expectations at the beginning of the wet season of 2022. The 2021 hydrological cycle was the driest recorded over 90 years and posed challenges for supply system and requested full dedication from all the bodies that compose the Electric Sector Monitoring Committee (CMSE),

Thermal power dispatches outside the order of economic merit were used whenever possible to preserve the level of the hydro reservoirs. Along with them, the discussion about the so-called “inflexibility” of hydroplants, associated with compulsory generation to meet other uses of water, and the safety limits used in the transmission operation were also constant. As water scarcity intensified, cyclical actions responded in the same direction, such as the approval, also by the CMSE, of energy imports from neighboring countries, the

easing of operational restrictions in hydro plants - in order to preserve reservoir levels and prioritizing other sources, also easing transmission restrictions, aiming to maximize power exports from N/NE to S/SE regions, in addition to negotiations to accelerate the start-up of new plants and transmission lines, publication of ordinances by the MME that allow the contracting of additional resources, implementation of the Demand Response Program for the ACR and Voluntary Demand Reduction for large consumers, in addition to contracting short/medium term installed capacity to connect to the power system and also assist in the recovery of the SIN reservoirs.

That is, during the challenge of meeting the energy demand in 2021, new short-term solutions were sought. And in addition to contributing to conjunctural decisions, through participation in the CMSE, CREG and other forums, EPE continued to work in the search for structural improvements, which together with the supply criteria approved by the CNPE in 2019 (remembering that the 2021 generation mix was planned 4, 5, 6 years ago, when the physical criterion of supply was energy-only, with a risk of deficit limited to 5% in each subsystem of the National Interconnected System), lead the Brazilian Electric Power System to the best balance between safety and cost, where new situations of shortage of supply can be overcome with the least possible number of short-term measures, in order to give greater predictability to operational decisions and planning actions, although aware that there is no international reference for “zero risk” planning.

The results of PDE 2031 are an important step towards the construction of these structural improvements, which involve the coordinated expansion of the generation and transmission power system, and it is worth noting that the cost of serving each MWh in the electric power system must be seen as a function of the total G + T (generation +

transmission), since the transmission networks make it possible to integrate more competitive generation into the system, reducing operating costs, allowing for increased exchanges and system flexibility, taking advantage of the complementarity of resources and projects.

In the electricity generation chapter, the lessons learned in the 2020/2021 biennium support the studies presented, especially in the new representation of the operational restrictions of hydroplants, which seeks to bring expansion planning closer to real-time operation. This new approach was used in all the analyses presented, from the requirements calculation to the expansion scenarios. The Reference Expansion Scenario also took into account the energy policy guidelines, notably the provisions of Law No. 14,182/2021. The results of this expansion were compared with the Free Scenario, where MDI decisions only take into account the costs and potential of each generation technology. In both scenarios, there is continuity in the process of diversifying the generation mix and reducing hydro dependence. And, this year, the current text does not present the sensitivity analyzes (what-ifs), however, the goal is to publish them in supplementary technical notes throughout the first half of 2022.

In the Electric Transmission chapter, important issues are addressed that are currently under discussion in the electricity sector and that permeate the recommendations of network expansions that make up this PDE. From this perspective, the various strategies that have been considered in the transmission expansion studies are described in order to enable the integration and flow of generation from the various energy resources, including wind and photovoltaic, which have been playing an important role in the Regulated Market – ACL (Portuguese acronym). These strategies reinforce the fundamental role of network expansion, not only by allowing the flow of large blocks of generation and meeting the market growth, but by adding reliability, flexibility in the operation of the grid and allowing the power system to take advantage of the characteristics of the

generation mix, both due to the diversification of resources and geographic dispersion. Furthermore, it seeks to characterize the evolution of the transmission capacity of regional electrical interconnections within the ten-year period, recognizing the relevance of these facilities for the optimal use of SIN resources. At the end of the chapter, important economic indications for the transmission sector are presented, including estimates of investment in transmission networks and substations in the coming years.

