

SUCCESS CASE 29.2026

CATÁLOGOS AT/MT

AI-POWERED PROBABILISTIC
PLANNING FOR HIGH- AND
MEDIUM-VOLTAGE NETWORKS



THE CHALLENGE

The energy transition is introducing increasing complexity into electricity network planning. The rapid growth of renewable generation, energy storage and distributed energy resources requires Distribution System Operators to make investment and design decisions under conditions of uncertainty, while ensuring long-term network efficiency and reliability. Traditionally, network planning and engineering decisions have relied on deterministic analyses and engineering expertise, which can limit the ability to assess probabilities, uncertainty and future network scenarios.

At the same time, evolving regulatory frameworks are increasingly requiring the use of probabilistic methodologies to justify network investments and assess alternatives such as flexibility services. E-REDES identified the need for more advanced decision-support capabilities to improve consistency in engineering decisions, strengthen investment justification and support the transition towards data-driven network planning.

THE SOLUTION

Catálogos AT/MT is an Artificial Intelligence-driven decision-support solution designed to transform the planning, design and investment processes of High Voltage (HV) and Medium Voltage (MV) networks. The solution combines historical network information, asset performance data and previous engineering decisions into a structured knowledge base, creating AI-powered probabilistic catalogues that support planning and engineering activities.

Advanced analytics models evaluate the probability and expected performance of alternative technical solutions and generate recommendations tailored to specific network situations. Engineers can then use these catalogues as decision-support tools when designing network reinforcements, evaluating investment alternatives and assessing flexibility solutions.

The solution follows a three-stage approach: data and knowledge integration, AI-based diagnosis and analysis, and decision support through actionable recommendations. By embedding probabilistic intelligence into engineering workflows, Catálogos AT/MT supports more standardized, consistent and transparent decision-making processes across the organization.

MAIN ACHIEVEMENTS

- Established AI-driven probabilistic methodologies for HV and MV network planning and investment decisions.
- Improved the ability to justify network investments using data-driven evidence and probabilistic analysis.
- Enhanced engineering standardization through AI-supported catalogues and structured decision-support processes.
- Strengthened the evaluation of flexibility alternatives alongside traditional network investments, supporting more efficient planning decisions.
- Generated estimated annual operational efficiency gains of 148 hours through optimized planning and engineering processes.

KEY SUCCESS FACTORS

A key success factor is the integration of multiple data sources, including historical network information, asset performance records and accumulated engineering knowledge. This comprehensive data foundation enables the development of probabilistic models capable of evaluating alternative network solutions with greater confidence and consistency.

Another important factor is the use of AI-driven analytics to transform engineering experience into repeatable and scalable decision-support catalogues. By capturing previous decisions and combining them with probabilistic modelling, the solution promotes standardization while preserving engineering expertise.

The initiative also supports compliance with the regulatory requirements established under Decree-Law 15/2022 by enabling probabilistic planning methodologies and strengthening the justification of network investments and flexibility alternatives.

WAY FORWARD

As electricity networks continue to evolve, E-REDES will further expand the use of AI-driven probabilistic methodologies to support network planning and investment decisions. Future developments will focus on enriching the knowledge base, refining predictive capabilities and increasing the integration of flexibility solutions within planning processes.

By combining artificial intelligence, engineering knowledge and probabilistic analysis, Catálogos AT/MT represents a significant step towards smarter and more efficient network planning. The initiative contributes to improved CAPEX efficiency, greater consistency in engineering decisions, enhanced renewable integration and long-term network optimization.