

The new challenges to transmission expansion planning. Survey of recent practice and literature review

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Abstract— Transmission Expansion Planning (TEP), the problem of deciding the new transmission lines that should be added to an existing transmission network in order to satisfy system objectives efficiently, is one of the main strategic decisions in power systems and has a deep, long-lasting impact on the operation of the system. Relatively recent developments in power systems, such as renewable integration or regional planning, have increased considerably the complexity and relevance of this problem. This is particularly true in the case of the European Union. These issues have motivated the appearance of a vast array of projects that propose specific development plans for the required transmission, together with academic literature that deals with the different theoretical aspects of the problem. It seems, therefore, pertinent to review these recent works and put them into context. This paper performs a critical review on TEP focusing on its most recent developments. It analyzes the current challenges to transmission planning and illustrates them with some instances of TEP in a European context. Then, it proposes a taxonomy of modeling decisions and solution methods for this problem, linking them to some of their main representative works in the literature with an emphasis on the most recent advances. These alternatives are critically compared, providing with insights that can guide researchers or practitioners when undertaking this kind of studies.

Index Terms— Transmission Expansion Planning, Optimization, Stochastic Optimization, Dynamic Optimization, Mathematical Programming, Heuristics, Metaheuristics.

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