

Transmission network expansion planning for the Colombian electrical system: connecting the Ituango hydroelectric power plant

G.E. Vinasco, D.A. Tejada, E.F. Da Silva, M.J. Rider

Abstract— The hydroelectric power plant HidroItuango represents a major expansion for the Colombian electrical system (with a total capacity of 2400 MW). This paper analyzes the possible interconnections and investments involved in connecting HidroItuango, in order to strengthen the Colombian national transmission system. A Mixed Binary Linear Programming (MBLP) model was used to solve the Multistage Transmission Network Expansion Planning (MTEP) problem of the Colombian electrical system, taking the N-1 safety criterion into account. The N-1 safety criterion indicates that the transmission system must be expanded so that the system will continue to operate properly if an outage in a system element (within a pre-defined set of contingencies) occurs. The use of a MBLP model guaranteed the convergence with existing classical optimization methods and the optimal solution for the MTEP using commercial solvers. Multiple scenarios for generation and demand were used to consider uncertainties within these parameters. The model was implemented using the algebraic modeling language AMPL and solved using the commercial solver CPLEX. The proposed model was then applied to the Colombian electrical system using the planning horizon of 2018-2025.

Index Terms— Multistage Transmission Network Expansion Planning; N-1 safety criterion; Scenarios for generation and demand; Mixed Binary Linear Programming

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