Expansion of transmission networks considering large wind power penetration and demand uncertainty

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Abstract-

This paper presents an algorithm for solving the Transmission Expansion Planning (TEP) problem when large scale wind generation is considered. Variability of wind speed and demand uncertainty are also taken into account. The formulation includes the DC model of the network, and the obtained expansion plans minimize the investment, the load shedding, and also the wind generation curtailment. The Chu-Beasley Genetic Algorithm (CBGA) is used for finding feasible optimal expansion plans. Uncertainties are included by scenario reduction to obtain robust expansion plans capable of meeting the uncertainty set. The approach allows finding robust expansion plans to cope with the uncertainties in load forecasting and also to take advantage of wind generation. The proposed algorithm is validated on the 6-bus Garver system, IEEE 24-bus RTS test system and the real life South-Brazilian 46-bus system. Comparison with other methods is carried out to demonstrate the performance of the proposed approach.

Index Terms- Transmission planning, robust optimization, uncertainty, wind generation.