Abstract Title

Co-optimization of Transmission and Other Supply Resources

Abstract Authors

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Abstract

Traditional models for planning transmission expansion, such as Integrated Resource Planning models, apply only to vertically integrated utilities. In deregulated electric systems, generation and transmission expansion planning is done separately, but at a potential cost of loss of coordination. Conflicting objectives and incomplete information in the planning process limit the integration of renewables and increase the cost of building and operating the systems. Modeling transmission expansion using co-optimization, the simultaneous identification of two or more classes of investment decisions within one optimization strategy, would provide a powerful planning tool for decision makers, addressing shortcomings of previous approaches, reducing system costs and supporting the integration of renewable generation.

Using detailed co-optimization models in planning has become more practical, due to developments in computer processing power and mature commercial and non-commercial MILP solver packages. Co-optimization can be used for two different approaches to planning. In a vertically integrated utility, co-optimization identifies transmission-generation expansions plans that together lower costs, compared with planning transmission and generation separately. Co-optimization may also be used in a restructured systems, where the generation and transmission are planned by different entities. In this context co-optimization planning allows transmission planners to expand their network considering anticipating that generation planners respond to the expanded network optimally.

We examine the benefits of co-optimization in transmission planning using two different co-optimization models, NETPLAN (a multi-sector simultaneous multi-period LP) and the JHU model (an electric sector MILP), applied to a 13 bus network reduction of the United States. In the models multiple rounds transmission and generation investments decisions were made, with decades of generation dispatch decisions. In both models, we found that the co-optimization approach yielded significant savings, up to 11%, over traditional planning, in which generation expansion is planned followed by transmission expansion. In traditional planning, the two planners make decisions with incomplete information about each other's objectives, resulting in suboptimal decisions. We also showed that approaches, in one model up to 80% cost reduction over traditional planning, approximating full co-optimization were not able to achieve the same benefits of full co-optimization.

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