

Impact of technical operational details on generation expansion in oligopolistic power markets

A. Nogales Gómez; E. Centeno Hernáez; S. Wogrin

Abstract-

Renewable generation technologies are expected to reach unprecedented penetration levels in a number of electric power systems. The increased deployment of these renewable technologies is changing the unit commitment of the rest of generation facilities, increasing the need for cycling. As a result, operation-related issues and their costs become more relevant for an adequate analysis of generation expansion problems. In this study, the authors propose a generation expansion model including an oligopolistic market representation based on an equilibrium approach. It introduces key operation-related constraints, such as minimum stable output, start-ups and shut-downs; and short-term operating costs, such as commitment, start-up and shut-down costs. The proposed model furthermore considers the discrete nature of capacity investment decisions. The authors also propose a heuristic method for solving the arising equilibrium problem, by providing an efficient starting point to the diagonalisation process. This heuristic can lead to reductions of up to 90% in computational time. Finally, case studies are presented in order to illustrate the importance of considering both operational details and a market framework when making generation expansion planning decisions.

Index Terms-

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