

# Generation capacity expansion in liberalized electricity markets: a stochastic MPEC approach

S. Wogrin; E. Centeno Hernáez; J. Barquín Gil

## Abstract-

This paper proposes a bilevel model to assist a generation company in making its long-term generation capacity investment decisions considering uncertainty regarding the investments of the other generation companies. The bilevel formulation allows for the uncoupling of investment and generation decisions, as investment decisions of the single investing generation company are taken in the upper level with the objective to maximize expected profits, and generation decisions by all companies are considered in the lower level. The lower level represents the oligopolistic market equilibrium via a conjectured price response formulation, which can capture various degrees of strategic market behavior like perfect competition, the Cournot oligopoly and intermediate cases. The bilevel model is formulated as an MPEC, replacing the lower level by its KKT conditions, and transformed into a MILP. Results from a study case are presented and discussed.

**Index Terms-** Generation expansion planning, bilevel programming, mathematical program with equilibrium constraints (MPEC).

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