

# Capacity expansion equilibria in liberalized electricity markets: an EPEC approach

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## Abstract-

This paper presents a novel way to model the generation capacity expansion problem in a liberalized framework via a multi-year bilevel equilibrium model. In the upper level the competing generation companies maximize their individual profits, while the lower level represents the market using a conjectured-price response approach, which allows us to vary the strategic spot market behavior, to see how much the reigning competitive behavior impacts investment decisions. The bilevel equilibrium model is formulated as an Equilibrium Problem with Equilibrium Constraints, transformed into a Mixed Integer Linear Program and solved as such using diagonalization in order to verify equilibria. We present a case study to apply this new modeling approach and to demonstrate that the proposed Equilibrium Problem with Equilibrium Constraints can have multiple solutions whose respective investments can vary.

**Index Terms-** Generation expansion planning, bilevel programming, equilibrium problem with equilibrium constraints (EPEC).

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