

Strategic analysis of electricity markets under uncertainty: A conjectured-price-response approach

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Abstract-

This paper presents a model to address generation companies' medium-term strategic analysis (including yearly forecast and decision-making processes) based on a conjectured-price-response market equilibrium representation that assumes a single node system. This equilibrium is formulated by simultaneous consideration that any of the variables that affect price formation—such as hydro inflows, demand, or fuel prices—are stochastic, by representing them through a scenario tree. It is shown that this equilibrium formulation can be solved by means of an equivalent optimization problem, which in most common cases becomes a quadratic programming problem. This schema enables taking advantage of the properties of classical medium-term operation optimization models, including clear model structure, reasonable computing solving time, and easy obtaining of dual-information. An annual study case (inspired by the Spanish electricity market) is presented, including two alternative demand levels in summer and three hydro-inflow situations, both in spring and autumn. In addition to the advantages previously mentioned, this approach provides richer results than a deterministic one, allowing companies to fit their policies more accurately to reality, thereby avoiding, for example, excessively optimistic or pessimistic decisions proposed by the deterministic analysis.

Index Terms- Conjectural variation, electricity markets, game theory, hydroelectric-thermal power generation, quadratic programming (QP), stochastic programming

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