Analysis of investments in generation capacity: a bilevel approach

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Abstract-

This paper introduces a bilevel model that represents the behavior of a firm which, faced with the need to build new plants, has to choose between a number of alternative technologies. The main contribution of the model is that the market representation (lower level) is made using a conjectured-price-variation approach. This formulation is able to represent different degrees of oligopoly in the market, which is a more realistic hypothesis than the perfect competition or Cournot oligopoly considerations. In the objective function of the upper level, the firm’s net present value is maximised, considering that the company is in an incumbent position and knows the new capacity that will be built by the others. A study case is analyzed to show the outputs corresponding to four different market behaviors: perfect competition, two intermediate oligopolistic market situations represented by different values for the conjectured variations, and Cournot oligopoly as an extreme oligopolistic situation. The results show that if a company is taken to be the only investing company at the investment level, the higher the degree of oligopoly in the market, the greater the investment and the greater the use of peak technologies.

Index Terms- Generation Expansion Planning, Bi-level programming, Mathematical Programs with Equilibrium Constraints

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