

Hydraulic Resources Management under Imperfect Competition with Thermal Plants in the Wholesale Electricity Market

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Abstract : In this paper, we analyze infinite discrete-time games between hydraulic and thermal power operators in the wholesale electricity market under Cournot competition. We consider a deregulated electrical industry where certain demand is satisfied by hydraulic and thermal technologies. The hydraulic operator decides the production in each season of each period that maximizes the sum of expected profits from power generation with respect to the stochastic dynamic constraint on the water stored in the dam, the environmental constraint and the non-negative output constraint. In contrast, the thermal plant is operated with quadratic cost function, with respect to the capacity production constraint and the non-negativity output constraint. We show that under imperfect competition, the hydraulic operator has a strategic storage of water in the peak season. Then, we quantify the strategic inter-annual and intra-annual water transfer and compare the numerical results. Finally, we show that the thermal operator can restrict the hydraulic output without compensation.

Keywords : asymmetric risk aversion, electricity wholesale market, hydropower dams, imperfect competition

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