

## Dynamics of Prices in Electric Power Networks

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### Abstract

The failure of deregulation in California is typically framed as the result of manipulation by ENRON, combined with high demand and scarce supply due to hot weather. Although it is likely that these factors were important, many questions remain. In particular, neither drought nor market manipulation are surprising to anyone living in California. Why didn't economists predict market failure?

High prices and price volatility are not unique to California. During the brief period of deregulation of electricity in Illinois in 1998, energy prices hit spikes of \$6,000 per megawatt hour, about 100 times the prices seen before deregulation. Even today, prices at the Amsterdam Power Exchange in Europe show tremendous volatility.

Market designs and analyses are typically based on very simple static models that ignore some very important aspects of the problem. In particular, prices rise when capacity becomes low relative to demand. This leaves little incentive for generators to increase capacity.

The goal of this research is to explain price volatility by examining a dynamic model of power distribution. A dynamic flow model constructed for a single-consumer model in analogy with a standard stochastic queueing model. Surprisingly, in the absence of transmission constraints, it is shown that there is a unique equilibrium that is efficient in the economic sense. However, in this equilibrium power prices show extreme volatility, and high average prices for power, just as seen in California in 2001.

*This is joint work with M. Chen and I.-K. Cho.*

**Bibliography**

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