



# **Stochastic Modeling of Electricity and Related Markets (Advanced Series on Statistical Science and Applied Probability) (Volume 11)**

*Fred Espen Benth*

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The markets for electricity, gas and temperature have distinctive features, which provide the focus for countless studies. For instance, electricity and gas prices may soar several magnitudes above their normal levels within a short time due to imbalances in supply and demand, yielding what is known as spikes in the spot prices. The markets are also largely influenced by seasons, since power demand for heating and cooling varies over the year. The incompleteness of the markets, due to nonstorability of electricity and temperature as well as limited storage capacity of gas, makes spot-forward hedging impossible. Moreover, futures contracts are typically settled over a time period rather than at a fixed date. All these aspects of the markets create new challenges when analyzing price dynamics of spot, futures and other derivatives.

This book provides a concise and rigorous treatment on the stochastic modeling of energy markets. Ornstein Uhlenbeck processes are described as the basic modeling tool for spot price dynamics, where innovations are driven by time-inhomogeneous jump processes. Temperature futures are studied based on a continuous higher-order autoregressive model for the temperature dynamics. The theory presented here pays special attention to the seasonality of volatility and the Samuelson effect. Empirical studies using data from electricity, temperature and gas markets are given to link theory to practice.

**Contents:** A Survey of Electricity and Related Markets; Stochastic Analysis for Independent Increment Processes; Stochastic Models for the Energy Spot Price Dynamics; Pricing of Forwards and Swaps Based on the Spot Price; Applications to the Gas Markets; Modeling Forwards and Swaps Using the Heath Jarrow Morton Approach; Constructing Smooth Forward Curves in Electricity Markets; Modeling of the Electricity Futures Market; Pricing and Hedging of Energy Options; Analysis of Temperature Derivatives.

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