



# Electricity price modeling and asset valuation: a multi-fuel structural approach

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We introduce a new and highly tractable structural model for spot and derivative prices in electricity markets. Using a stochastic model of the bid stack, we translate the demand for power and the prices of generating fuels into electricity spot prices. The stack structure allows for a range of generator efficiencies per fuel type and for the possibility of future changes in the merit order of the fuels. The derived spot price process captures important stylized facts of historical electricity prices, including both spikes and the complex dependence upon its underlying supply and demand drivers. Furthermore, under mild and commonly used assumptions on the distributions of the input factors, we obtain closed-form formulae for electricity forward contracts and for spark and dark spread options. As merit order dynamics and fuel forward prices are embedded into the model, we capture a much richer and more realistic dependence structure than can be achieved by classical reduced-form models. We illustrate these advantages by comparing with Margrabe's formula and a simple cointegration model, and highlight important implications for the valuation of power plants.

Subjects: **Pricing of Securities (q-fin.PR)**

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