

CO-INTEGRATION IN ENERGY MARKETS

—Clean Spark Spread Option Pricing

by

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A thesis submitted in partial fulfillment of the requirements for
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Based on the co-integration between prices of power, gas and emission, my thesis provides a model for clean spark spread option pricing. For a power plant, gas and emission are inputs and power is the output. Co-integration should exist between power price and a combination of gas and emission prices. This co-integration relationship is considered when modeling the power price process based on gas and emission price levels. The clean spark spread process is the difference between the power price and the combination of gas and emission prices, and the option price is the expected payoff of the option. A co-integration test is conducted on real market data using Engle-Granger two-step test with augmented Dickey-Fuller test. The test result indicates the existence of co-integration relationship, which validates the crucial co-integration assumption in the model. The parameters of the model are calibrated by maximum likelihood method, and the option price is calculated by Monte Carlo simulation. The co-integration based model gives more realistic clean spark spread level and option price than the widely used two-factor model. The methods and finding in this thesis can be easily applied to other spread families.