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Investment in electricity capacity under fuel cost uncertainty: Dual-fuel and a mix of single-fuel technologies

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We study the effect of the price and price volatility of natural gas on investment in electricity capacity in two technology scenarios: (1) dual-fuel units that use natural gas and diesel; and (2) a mix of single-fuel plants that use coal or natural gas. We develop a two-stage (capacity and operation) model and derive analytical solutions for both scenarios. We show, based on the observed log-normal distribution of the natural gas price, that optimal capacity investment increases moderately with natural gas price volatility, thereby disputing a commonly held view that fuel cost uncertainty tends to discourage capacity investment and reducing the “missing money” problem. We use Texas data to show that higher gas price volatility implies higher profits and consumer surplus in the first scenario, even when the per MWh diesel cost is much higher than the expected value of the per MWh gas cost. In the second scenario, firms invest only in gas capacity, unless the per MWh coal cost is significantly below the expected per MWh gas cost, explaining the popularity of gas generation.