

Weather Variability and Energy Production: The Effect of Drought on Electricity Prices

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BACKGROUND

Electricity sales in Texas spiked during a prolonged heat wave and subsequent severe drought in the summer of 2011, and electricity prices increased across the state. The highest systemwide hourly peak demand to that point occurred in August of 2011, reaching 68,305 MW. During this time, at least one plant curtailed night-time operations, several plants switched from their normal sources of water to alternate sources or added new pumps to reach existing sources, and operators prepared emergency plans to enact demand management and bring mothballed plants online. Though the increase in electricity prices was caused in part by increased demand for air conditioning, some of the increase in prices could also be explained by drought-induced shifts in plant availability or increased costs of obtaining sufficient cooling water supplies. The simultaneous supply and demand shocks led to extremely high prices, increased electricity demands, and increased water demands. The effects of drought on power plant cooling is increasingly discussed in the engineering and climate science, but little work on the effect of drought on market outcomes in the electricity sector has been performed.

OBJECTIVES

- Determine the effect of drought on electricity prices and patterns of electricity production in Texas
- Determine whether the type of cooling technology used in each plant has an effect on which plants produce electricity and the market price for electricity

FINDINGS AND BENEFITS

- We test whether drought conditions have a significant effect on electricity price and quantity bids of electricity plants for the years 2010--2016 using hourly ERCOT data
- We find that drought has significant effects on electricity prices and electricity grid outcomes, and argue that public policy towards electricity markets and drought management will need to be aware of these effects
- The risk of drought can have an impact on both the risk of grid failure (brownouts or blackouts) and welfare of power consumers as prices rise