Danny Greer Thesis Abstract

The ever-growing interest in climate change mitigation continues to promote the growth of renewable sources of electricity in our country. Texas is on the forefront of that growth with the second highest penetration of renewable resources of any state in the U.S. It is therefore imperative to understand how this growth will impact a market that was not originally designed to handle significant renewable penetration. Because ERCOT is an energy-only market, where prices are largely based on the short run marginal cost of a generator, there is a risk that, as renewable penetration increases, and low marginal costs technology are more frequently setting the wholesale electricity price, generators may not earn enough revenue to incentivize investment in new capacity to maintain grid reliability. Using a multi-model analysis, I investigate the impact of increasing renewable penetration, and whether those renewables are dispatchable versus variable, on electricity prices, capacity mix, and grid reliability. I also look at how reserve requirements and price caps further impact these results. I found that, at renewable penetrations greater than 60%, we start to see an increase in the number hours with prices at or near $0/MWh. Additionally, at this penetration level, we start to see peak prices, up to $50,000/MWh in the 100% renewable scenarios. I then implemented a series of price caps at $4,500; $9,000; and $20,000/MWh, and found that, while a price cap does suppress peak prices, it also results in dropped load due to prices not being high enough to compensate new capacity to serve that load. Access to dispatchable technologies helps mitigate these issues by providing a resource with higher short run marginal costs that can be turned up or down when needed. Based on these findings, Texas and the PUCT should consider new mechanisms to compensate assets for providing long term reliability services to help encourage market participants to play a larger role in the security of the Texas grid.

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