Duct-taping the U.S.'s Last Energy-Only Market: ERCOT

BY JAY ZARNIKAU, CHI-KEUNG WOO, SHUANGSHUANG ZHU AND CHEN-HAO TSAI

Economists have long debated whether market prices set at short-run marginal costs will generate sufficient long-term revenues to provide a reasonable return to existing suppliers and sufficient incentive to attract new investment in a capital intensive industry with high fixed costs. Affirming DuPuis (1844) and Hotelling (1938), Joskow (2013) concluded there is a 'missing money' problem in restructured electricity markets. Yet, not everyone is convinced that a capacity market, a resource adequacy requirement or some other administrative intervention is necessary to maintain a competitive and reliable electricity market in the long run (e.g., Kielsing and Kleit, 2009; Biggar and Hesamzaden, 2014).

Like other regions in North America, the Electric Reliability Council of Texas (ERCOT) has recently experienced low wholesale market prices, chiefly due to the low natural gas prices caused by the explosive growth in shale gas supply. These low wholesale market prices have rendered the continued operation of many coal plants in Texas uneconomical. Three large coal plants retired in early 2018, another coal plant may shutter before the summer of 2019, and a further coal plant is scheduled to retire in 2020. Further, the state's renewable energy development has reduced wholesale market prices via the merit order effect (Zarnikau et al. 2019). The coal plant closures and renewable energy's continued expansion, along with renewable energy production's negative correlation with load, underscore Texas's problem of low reserve margin projected in the next few years.

Until recently, the ERCOT market relied solely on market forces to retain existing generating plants and incent investment in new plants to ensure long-term reliability. In June 2014, however, it introduced an operating reserve demand curve (ORDC) to raise wholesale prices during times of capacity scarcity (Hogan, 2013).

Fig. 1 shows that the ORDC price adder is administratively set at the value of loss of load (VOLL) of $9,000/MWh when ERCOT's operating reserves are less than the minimum level of 2,000 MW. At levels of reserves above 2,000 MW, it is the VOLL times the loss-of-load probability (LOLP) of a system emergency within one hour. It declines to $0/MWh as ERCOT's operating reserves increase to ~5,000 MW, reflecting the LOLP estimate's rapid shrinkage to zero.

The ORDC has a limited impact on wholesale electricity prices when ERCOT's capacity scarcity is moderate. In 2016, for example, its price adder represented about 1% of the total price of energy paid by a consumer of wholesale energy in the ERCOT market.

Facing the prospect of a 7.4% reserve margin in the summer of 2019 and continued low planning reserves in subsequent years, the Public Utility Commission of Texas (PUCT) approved changes to ERCOT's ORDC in January 2019, so as to raise wholesale prices during periods of low operating reserves (Walker, 2019). The PUCT concluded that the economically-optimal or market equilibrium levels of generating capacity under ERCOT's energy-only market structure were too low from a policy and economic development perspective[1]. In January 2019, the PUCT approved shifting the ORDC based on the standard deviation (SD) of the hour-ahead operating reserve forecast error's distribution. The initial shift in 2019 is based on 0.25 SD and the second shift in 2020 0.50 SD. Figure 1 portrays that the approved shifts greatly magnify the ORDC price adder at levels of operating reserves above 2,000 MW.

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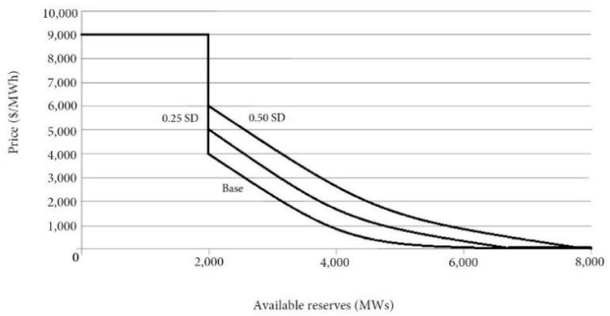

Figure 1. Price effects of the PUCT's approved shifts

A backcast of the ORDC price adders in the 4-year period of 2015-2018 indicates that shifting the ORDC would have greatly increased ORDC collections in 2018. Table 1 shows that the total electricity cost in 2018 was $14.24 billion at the recorded real-time prices, of which $0.75 billion was due to the ORDC. The 0.25 SD shift would have increased total ORDC collections to $2.11 billion, a $1.36 billion or 180% increase from the actual ORDC payment. This would represent a 9.5% increase in total electricity cost for 2018. The 0.5 SD shift would have increased the total ORDC collection to $3.25 billion, a $2.5 billion or 332% increase from the actual ORDC collection. However, the ORDC shifts' impact in

	2015	2016	2017	2018
Actual energy cost	9.63	8.91	9.55	14.24
Actual ORDC payment	0.49	0.10	0.09	0.75
Energy cost based on a 0.25 SD shift	10.14	9.13	9.76	15.59
ORDC payment based on a 0.25 SD shift	1.00	0.32	0.29	2.11
Energy cost based on a 0.50 SD shift	10.71	9.35	9.96	16.74
ORDC payment based on a 0.50 SD shift	1.57	0.55	0.5	3.25

Table 1. Backcast of annual energy cost and ORDC payment ($Billion)

the other three years would have been far smaller.

We use Table 1 to answer the policy question: could a shift in the ORDC ensure Texas's resource adequacy? Had the redesigned curves been in effect in 2018, it might have indeed been effective in delaying some coal plant closures and attracting additional investment in generating capacity. The same cannot be said about the other three years. Further, Table 1 indicates very large year-to-year variation in ORDC payments, presaging that the ORDC's impact over the next couple of years of slim planning reserves could be even greater than those backcasted for 2018. Such highly volatile ORDC impacts will continue to make generation investments in the ERCOT market quite a gamble.

To conclude, we concur with the PUCT order that absent the approved ORDC shifts, ERCOT's wholesale prices will likely remain low for two reasons. First, low natural gas prices are expected to persist. Second, a review of planned resource additions for the ERCOT market suggests that Texas's wind and solar generation is likely to increase, thus suppressing ERCOT's wholesale market prices (Zarnikau et al., 2019). Hence, duct-taping ERCOT's energy-only market structure by modifying the ORDC is deemed effective in mitigating ERCOT's capacity scarcity in the near term. But only time can tell whether this strategy will work in the long run.

Footnote

[1] Market forces alone are projected to yield an "economically-optimal" reserve margin of 9% and a market equilibrium reserve margin (additionally reflecting the original ORDC's impact) of 10.25% (Brattle, 2018).

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Bios

Student Happy Hour Gathering

BY PABLO BENALCAZAR, IAEE STUDENT COUNCIL REPRESENTATIVE

The Student Happy Hour and Gathering took place on Wednesday, May 29 at the Café-Bar Le Saint-Sulpice, well known for its garden terraces and nested at the famous Quartier Latin. The event is one of the most popular among all students and it is aimed at providing an informal evening where participants can widen their network and share ideas. Student Council Representative, Pablo Benalcazar, welcomed all student members and went on to highlight the benefits of being a member of IAEE such as complimentary access to all conference proceedings and IAEE's periodical publications, reduced conference fees, eligibility to take part in the IAEE European PhD Day, compete in the Student Best Paper Award at the IAEE International Conference, present their work in poster sessions in a multitude of IAEE conferences, and join a Student Chapter.