

ERCOT: success (so far) and lessons learned

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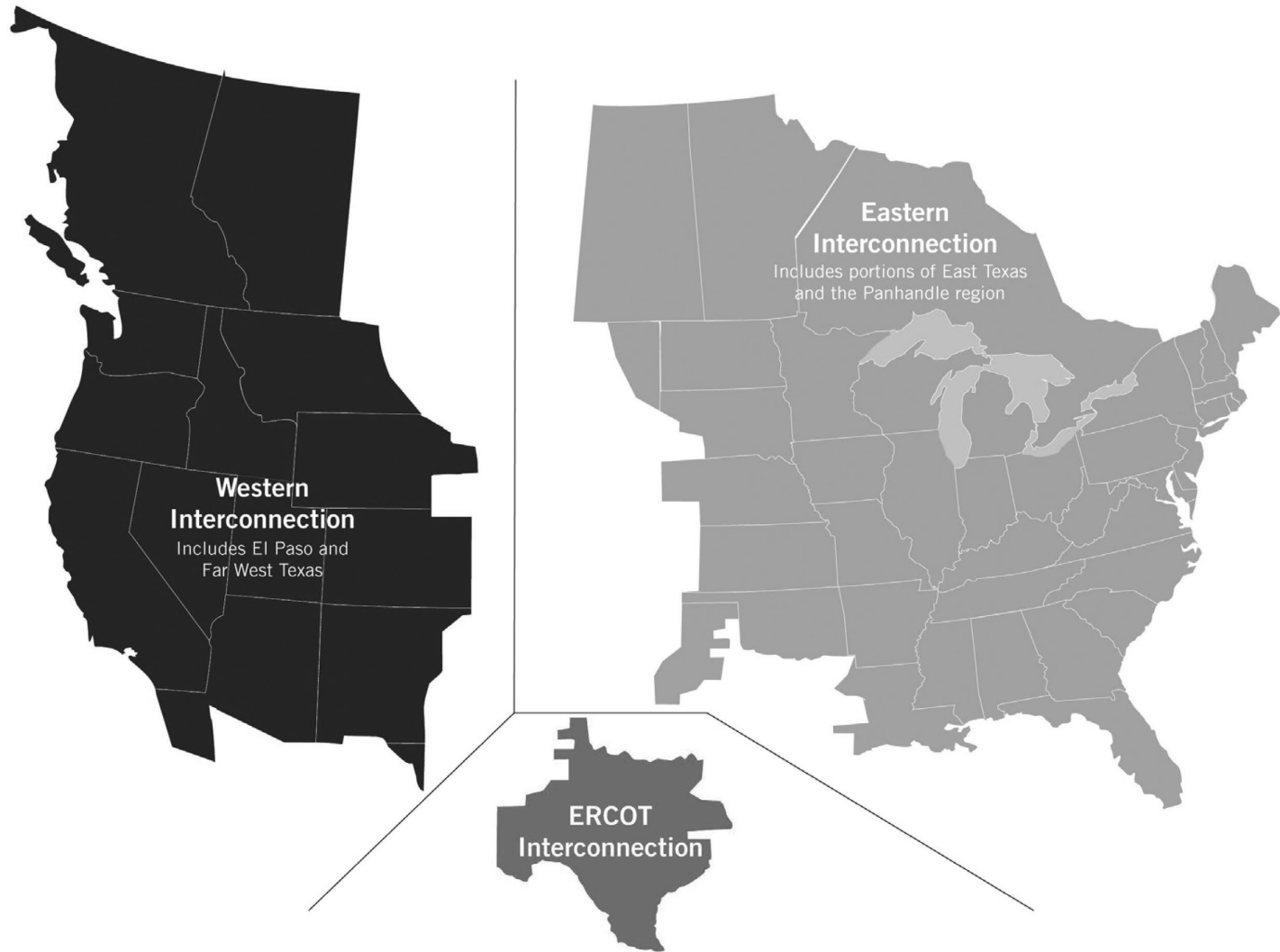
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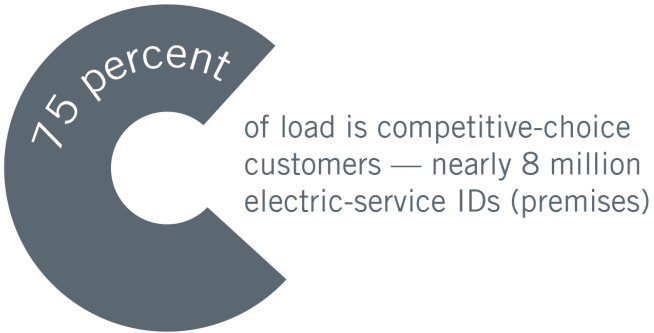
THE USA ELETRIC POWER GRID



Source: ERCOT, www.ercot.com.²



More than
26 million
customers in the
ERCOT region



- 1,800+ active market participants that generate, move, buy, sell or use wholesale electricity
- 86,000+ megawatts (MW) of expected capacity for summer 2021 peak demand
- 710+ generating units, excluding PUNs
- Transmission projects endorsed in 2020 total \$1,071 million
- 46,500+ miles of high-voltage transmission



- Wind Generation record: 23,596 MW (June 25, 2021)
- Wind Penetration record: 66.47 percent (Mar. 22, 2021)
- Solar Generation record: 7,036 MW* (Aug. 3, 2021)
- 27,287 MW of installed wind capacity as of August 2021, the most of any state in the nation
- 5,260 MW of utility-scale installed solar capacity as of August 2021
- 459 MW of installed battery storage as of August 2021

* New records are preliminary, subject to change in final settlement

74,820 MW

Record peak demand
(Aug. 12, 2019)

73,821 MW

Weekend peak demand record
(Aug. 15, 2020)

1 MW of electricity can power about 200 Texas homes during periods of peak demand.

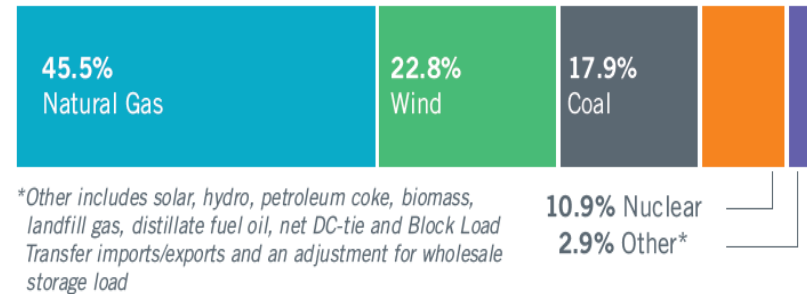
2021 Generating Capacity

Reflects operational installed capacity based on the December 2020 CDR report



**Other includes hydro, biomass-fired units and DC tie capacity*

2020 Energy Use



**Other includes solar, hydro, petroleum coke, biomass, landfill gas, distillate fuel oil, net DC-tie and Block Load Transfer imports/exports and an adjustment for wholesale storage load*

382 billion kilowatt-hours of energy were used in 2020, a 0.6 percent decrease compared to 2019.

The grid operator is regulated by the Public Utility Commission of Texas and the Texas Legislature.

ERCOT has four primary responsibilities:

- Maintain system reliability.
- Facilitate a competitive wholesale market.
- Facilitate a competitive retail market.
- Ensure open access to transmission.

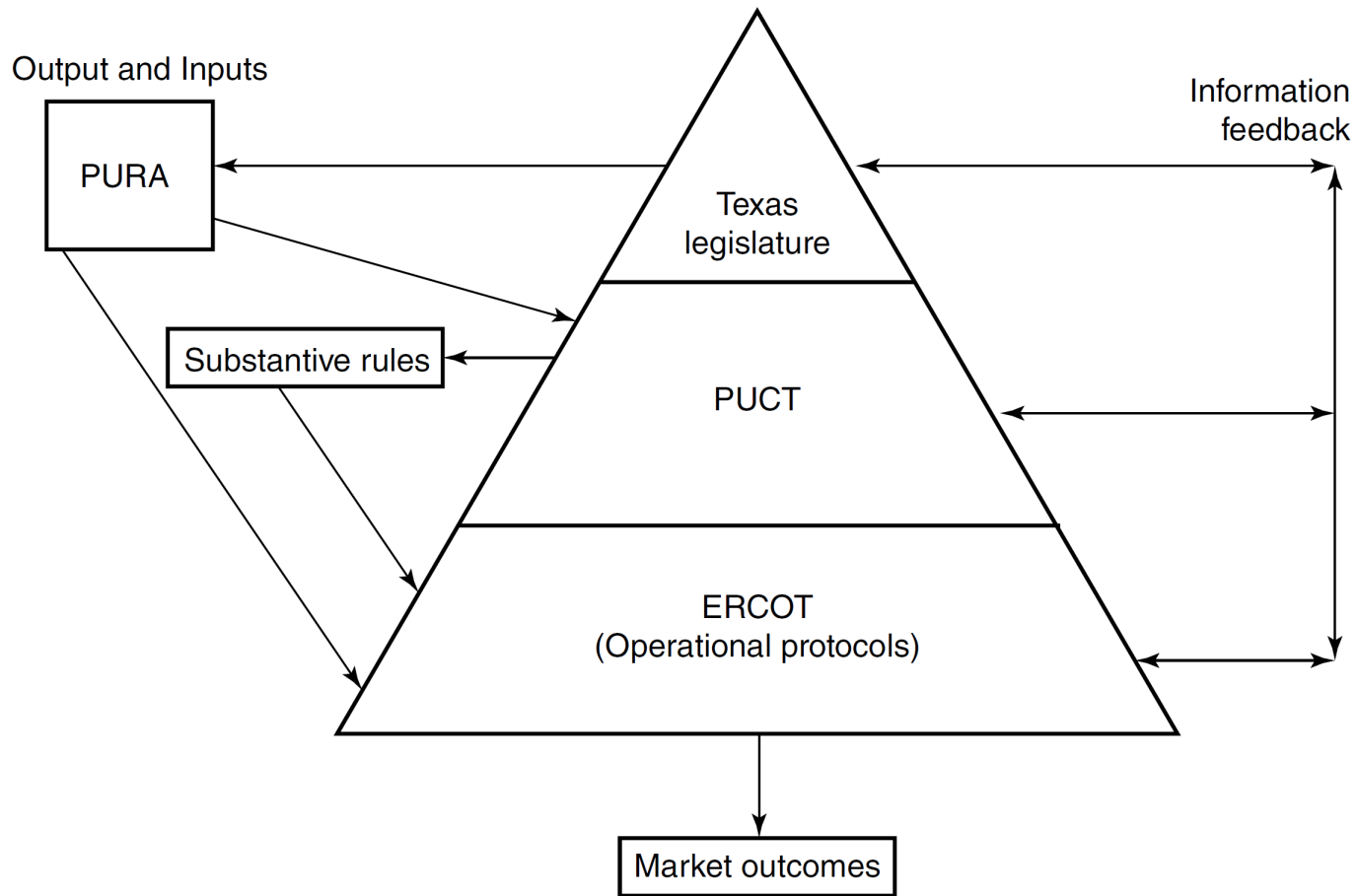
The Elephant in the Room

In mid-February 2021, Texas endured a 1-in-30-year cold weather event where a large swath of electricity customers in ERCOT were without power for 48–96 hours. The Texas Legislature subsequently passed legislation ordering the PUCT to make certain changes to the ERCOT market to correct problems that were identified during the event.

Features of the ERCOT Market

- Retail Choice
- State policies facilitation technological innovation
 - Encouraging Renewables through CREZ and RPS
 - Mandating smart metering
- Texas Nodal
- Energy Only Market with no obligation to serve
- Scarcity prices through Operating Reserve Demand Curve (ORDC)
- Market monitoring and market power mitigation
- Circuit Breakers

Three-Tiered Governance



Source: Adapted from Ostrom (2005, p. 59).

Implementing Retail Choice in the ERCOT Market

- Mass market customers encouraged to shop for independent energy providers (REPs) with easy switching registration managed by ERCOT.
- “Price to beat” policy froze incumbent utility rates for mass market customers below pre-restructuring rates, indexed to gas prices.
- 20% limit on generation capacity share by PGCs or affiliates to control market power (Munis exempted).
- Mass deployment of smart meters (currently cover 98% of load) enables 15 minute settlement and varied flexible product offerings by REPs.
- Strong political mandates for retail competition
- Consistent PUCT policy to remove import constraints into large load centers and make the transmission network more robust in the South and West load zones.

Facilitating new technologies

The Texas Legislature made three key policy decisions in the second quarter of 2005 to facilitate the integration of new technologies on the ERCOT grid.

- Increasing the RPS
- Transmission expansion with socialized cost under the CREZ policy, to enable the construction of new transmission lines in areas with a strong potential for wind and solar development in West Texas and the Texas Panhandle
- Mass installation of smart meters

Market Design Evolution

- Initial design ignored technical constraints and allowed portfolio bidding.
- Pervasive gaming such as the “DEC game” and adverse selection of generation units to meet portfolio awards led to the introduction of unit specific bids with zonal pricing, and ultimately nodal pricing.
- Energy only market was strongly supported by the REPs who view their role as providing hedges to retail customers against volatile wholesale prices.
- System operator use of operating reserves to avoid shortages also muted scarcity signals, eventually leading to the ORDC to provide scarcity price signals and eliminate reliance on market power for setting high prices.
- Bid-based central unit commitment with guaranteed make whole payment was instituted with cost verification that created strong incentives for self-dispatch.
- Initial design addressed market power by limiting market share to 20% and allowing small fish to swim free. This proved inadequate leading to more stringent market power mitigation based on structural screens with active substitution DEBs.

Managing Complexity and Meeting Challenges

- Changes in ERCOT nodal protocols to facilitate wind integration (25 GW)
- Operating reserve demand curve (ORDC)
- Market performance and tight reserve margins in summer 2019
- Integrating distributed energy resources

Recipe for Success (so far)

- Supportive political and economic climate.
- Texas geography. (single state system)
- Booming local economy.
- Style of governance.
- Prominent role of business community and stakeholders in influencing the market debate.
- Independence from FERC.
- Clear and consistent policy directives.