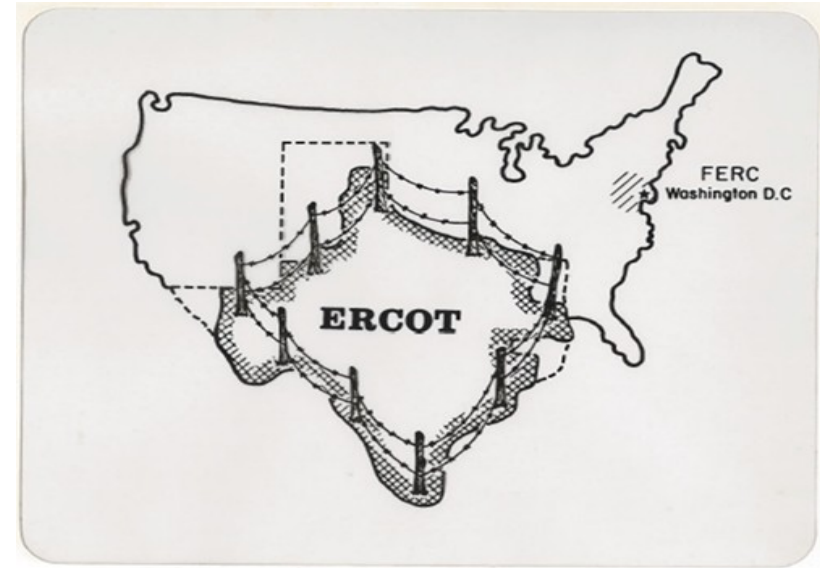


Competitive Electricity Markets in Texas: The Past 20 Years



Jay Zarnikau
The University of Texas at Austin

And What Changes are being considered in light of the performance of the market during February's Winter Storm??



Outline

- The evolution of the Texas electricity market
 - History and legislative framework
 - The Wholesale Market
 - The Retail market
- The Valentines Vortex
 - What went wrong?
 - The Issues
 - Policy Response
- My Thoughts

Why Study Texas?

- Texas is often cited as North America's most successful restructured market
 - For many years, there was vibrant competition at the retail level
 - The wholesale market functioned fairly well (well, at least until February 2021)
- Texas has probably the most unregulated electricity market in North America
 - An “energy only market,” relying extensively on the forces of supply and demand to preserve reliability
 - There is very minimal regulation over retail prices and services

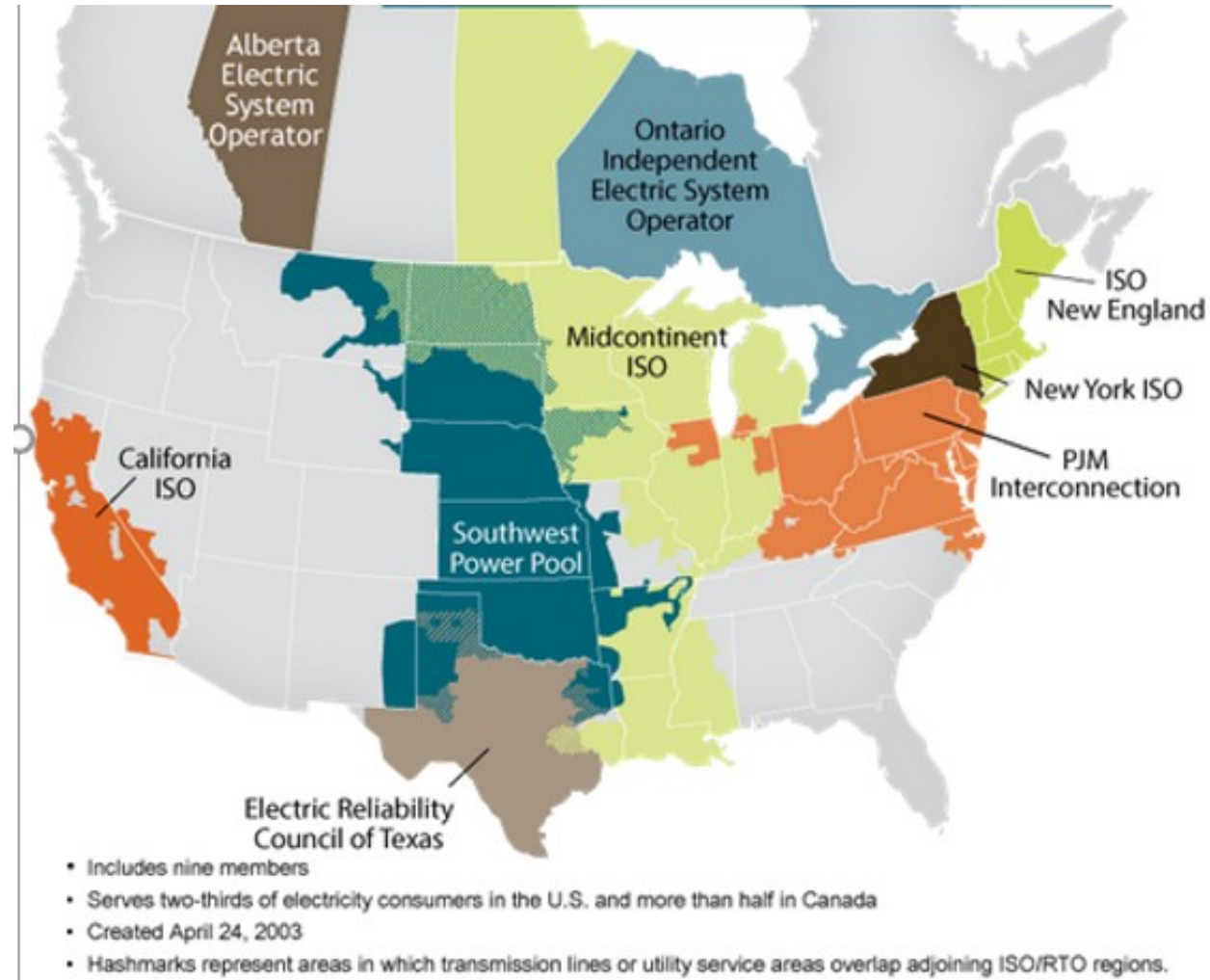
Competition in the Electric Reliability Council of Texas (ERCOT) Market

- Wholesale competition was gradually introduced over three decades:
 - Cogeneration or Combined Heat and Power forms of electricity generation were promoted in the 1980s, exceeding 8 GW by the end of the decade.
 - This led to a lot of independent power production beginning in the late 1980s.
 - Wholesale competition was formally introduced in 1995, creating the first independent system operator (ISO), though its responsibilities were limited.
- Retail competition introduced:
 - Legislation was enacted in 1999 requiring full customer choice by January 2002.
 - Price-to-Beat (PTB) regulated transitional default pricing for customers who did not exercise their right to choose expired in January 2007.

Impetus for Restructuring

- Large industrial energy consumers thought they could obtain access to cheaper power supplies.
- Power marketers and independent power producers (e.g., Enron and Shell Oil) wanted to play a bigger role in the retail sector.
- A booming economy led to relatively-high demand growth and new business opportunities.
- There is a general distrust of government in Texas. Thus, a reduced role for government regulation was considered to be attractive, particularly under Governor George W. Bush's administration.
- High prices was *not* much of a driver, in contrast to other states. Nonetheless, it was often claimed that restructuring would reduce Texas's electricity prices even further.

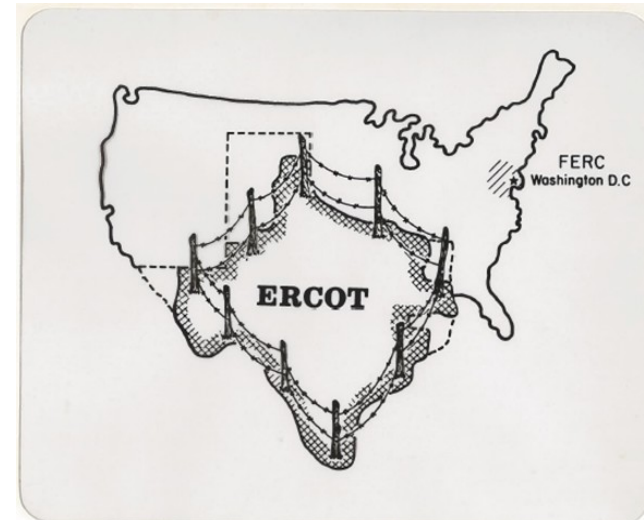
ERCOT is one of North America's formal markets



Source: <http://www.iso-rto.org/about/default>

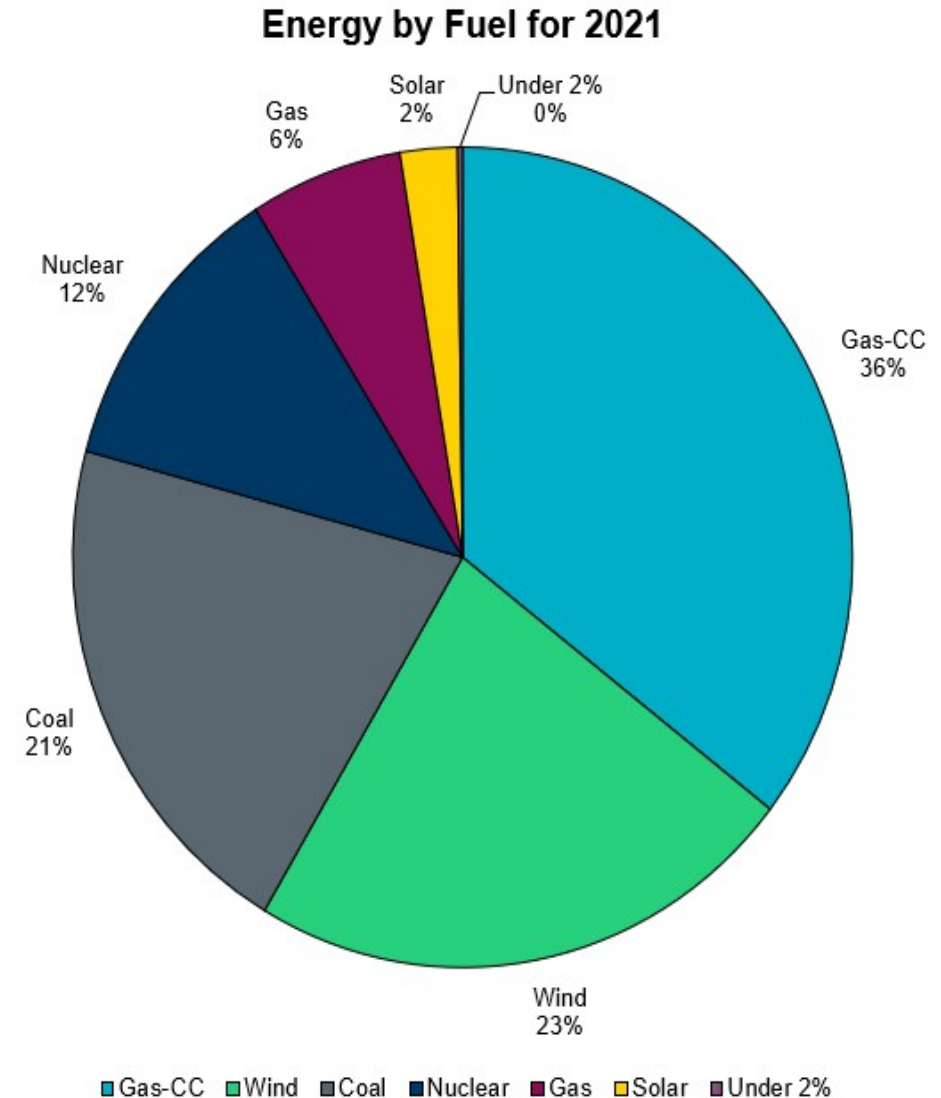
The Unique Status of Texas

- The Electric Reliability Council of Texas (ERCOT) reliability council is not connected to the rest of North America (at least not with A.C. ties).
- Thus, ERCOT is not involved in interstate commerce, and federal jurisdiction within the Texas electricity market is very limited.
- Most of the utilities in Texas intentionally electrically isolated themselves from the rest of the utilities in the U.S. in 1935 to avoid falling under the Federal Power Act.
- An implication of this is that there is more *state-level* regulation over the wholesale market in Texas than in nearly any other state.



Resources and Generation Mix

Operational Resources (thermal and hydro), MW	65,565
Switchable Capacity Total, MW	3,691
Less Switchable Capacity Unavailable to ERCOT, MW	(558)
Capacity from Private Use Networks, MW	2,799
Coastal Wind, Peak Average Capacity Contribution, MW	2,203
Panhandle Wind, Peak Average Capacity Contribution, MW	1,543
Other Wind, Peak Average Capacity Contribution, MW	5,818
Solar Utility-Scale, Peak Average Capacity Contribution, MW	2,494
Non-Synchronous Ties, Capacity Contribution, MW	838
Planned Thermal Resources with Signed IA, Air Permits and Water Rights, MW	306
Planned Coastal Wind with Signed IA, Peak Average Capacity Contribution, MW	809
Planned Other Wind with Signed IA, Peak Average Capacity Contribution, MW	1,634
Planned Solar Utility-Scale, Peak Average Capacity Contribution, MW	1,513
[a] Total Resources, MW	88,654
[b] Peak Demand, MW	64,548
[c] Reserve Capacity [a - b], MW	24,106



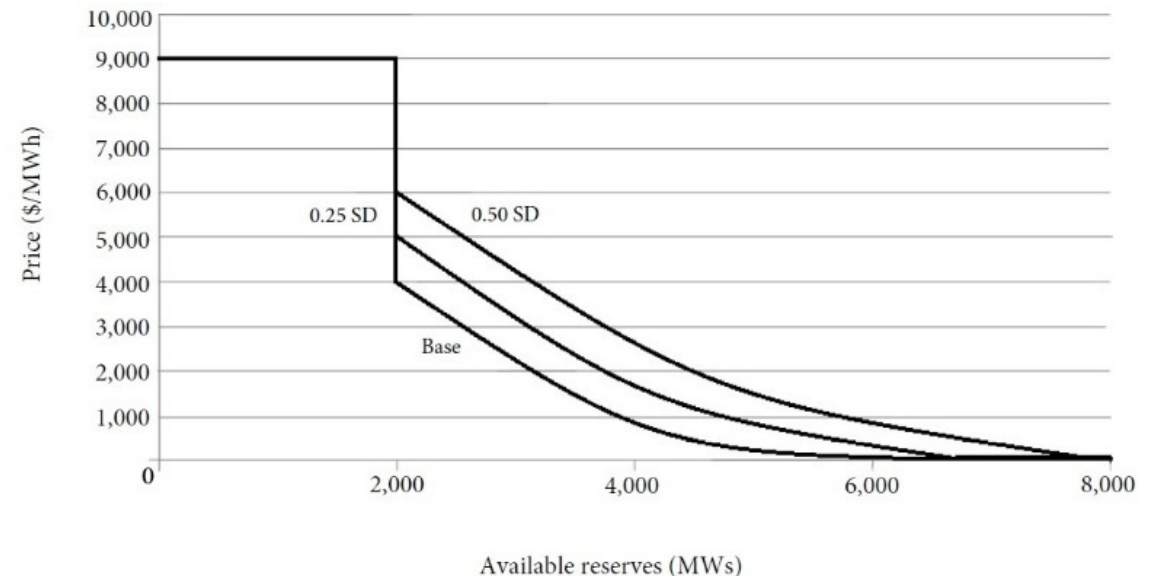
Attributes of the Wholesale Market

- The market is *unbundled*. Generation, transmission and distribution, and retail sales functions have been separated. Yet, companies serving different functions may be under common ownership.
- There is a mix of investor-owned utilities (IOUs), municipally-owned systems, rural electric coops, and independent power producers (IPPs).
- The independent system operator (ISO) dispatches resources to maintain reliability and operates markets for energy and ancillary services
- The wholesale market structure switched from “zonal” to “nodal” in December 2010.
- A Day-Ahead Market was also introduced in December 2010.

The Operating Reserve Demand Curve (ORDC)

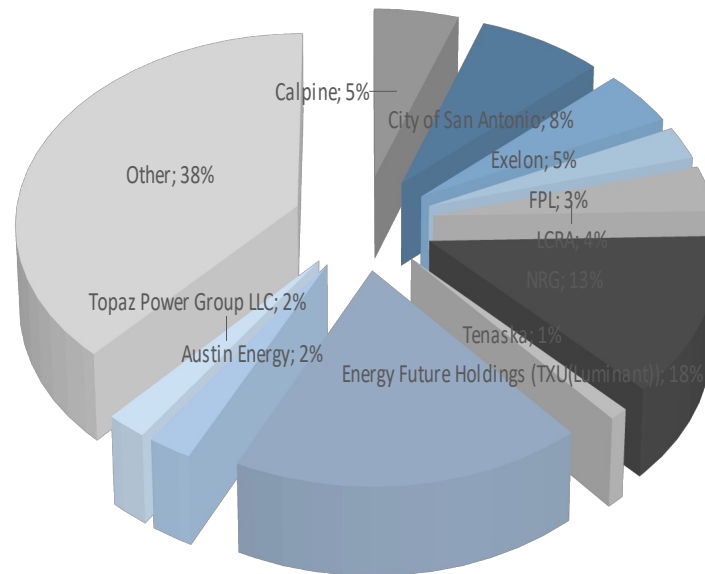
- We had a “missing money” problem and needed to provide additional revenue to generators to improve the profitability of investment in generating resources.
- Given great resistance to introducing a capacity market or imposing resource adequacy requirements upon any market participant, an administrative mechanism was designed to raise prices when operating reserves approached low levels. (See papers by Hogan)
- This ORDC was introduced in June 2014, but had little impact on prices until it was modified in March 2019 and again in March 2020.

- See: J. Zarnikau, S. Zhu, C.K. Woo, C.H. Tsai, Texas’ operating reserve demand curve’s generation investment incentive, *Energy Policy*, 2019.



Generation Market Share in ERCOT

Generation Market Share in ERCOT without Wind Generation (As Of March 2015)

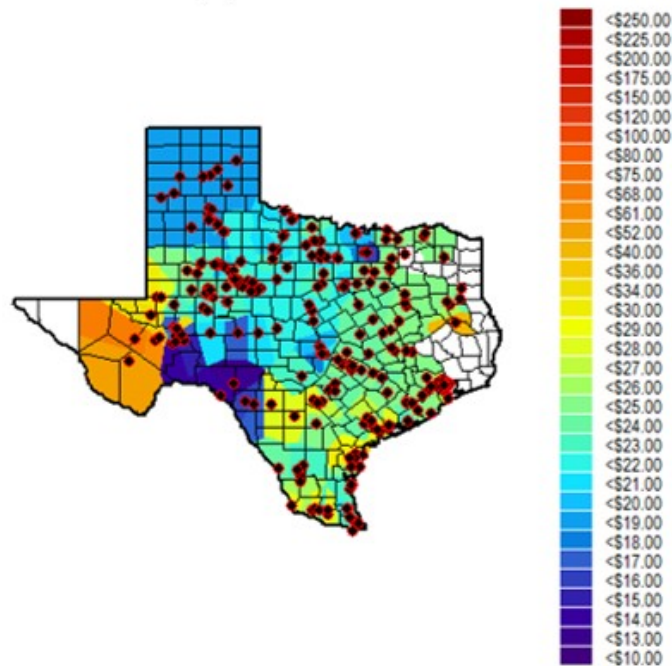


The ERCOT market probably has the highest supplier concentration among all of North America's "competitive" wholesale markets.

What about that theory that resource investments would locate in high-price nodes?

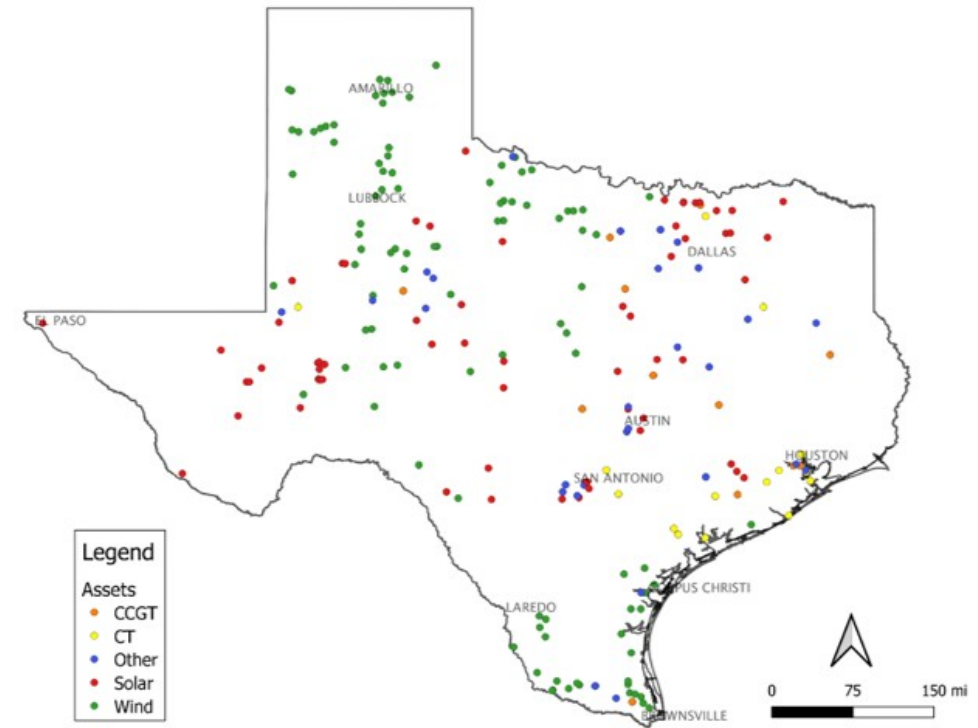
- The evidence seems weak.
- Factors other than differences in nodal prices are more likely drivers of utility-scale generation capacity investment location decisions.

- D.P. Brown, J. Zarnikau, C.K. Woo, Does Locational Marginal Pricing Impact Generation Investment Location Decisions? An Analysis of Texas' Electricity Market. J of Reg. Economics, 2020.



(b) 2019

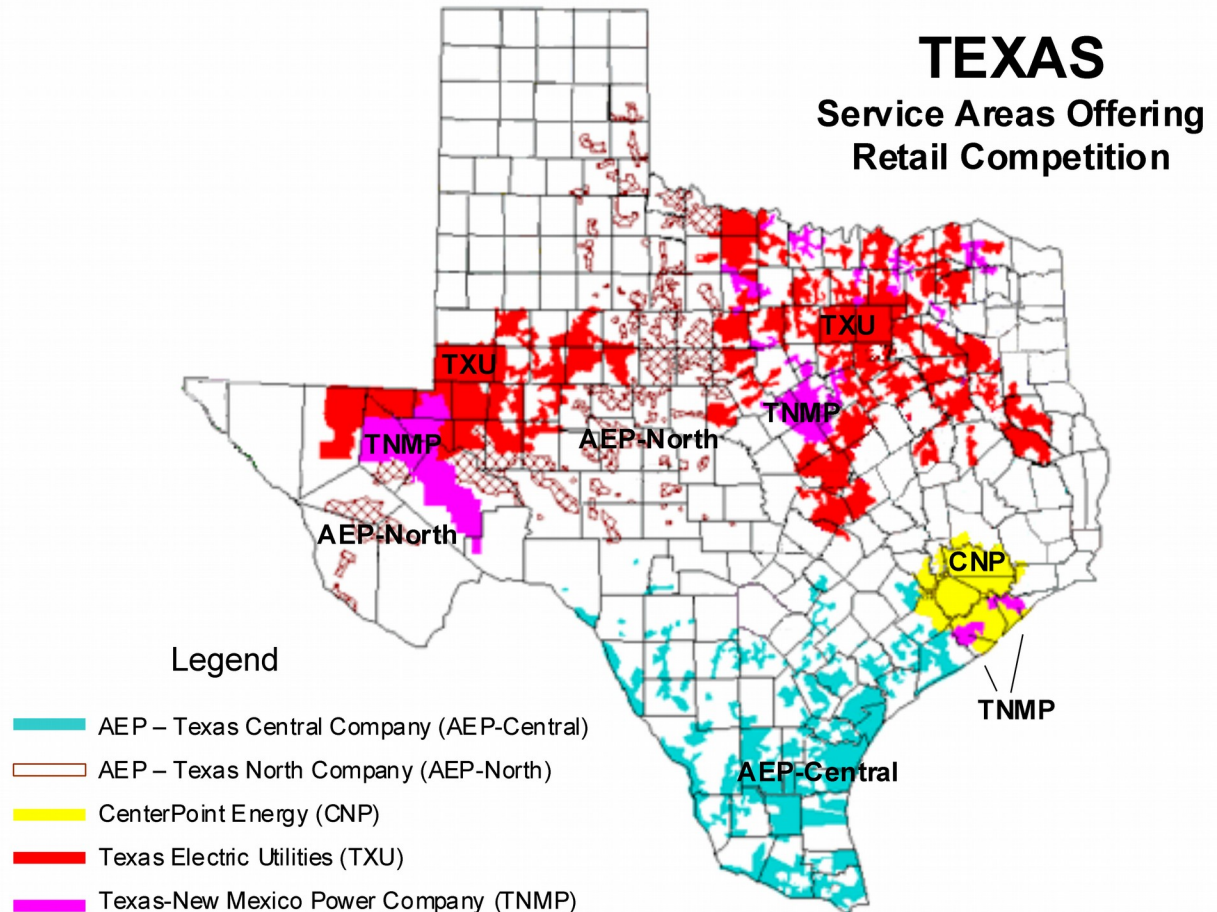
LMP Contour Map – Average Nodal LMPs¹³



New Generation Units by Location and Technology (2011 – 2022)

Switching to the Retail Side of the Market

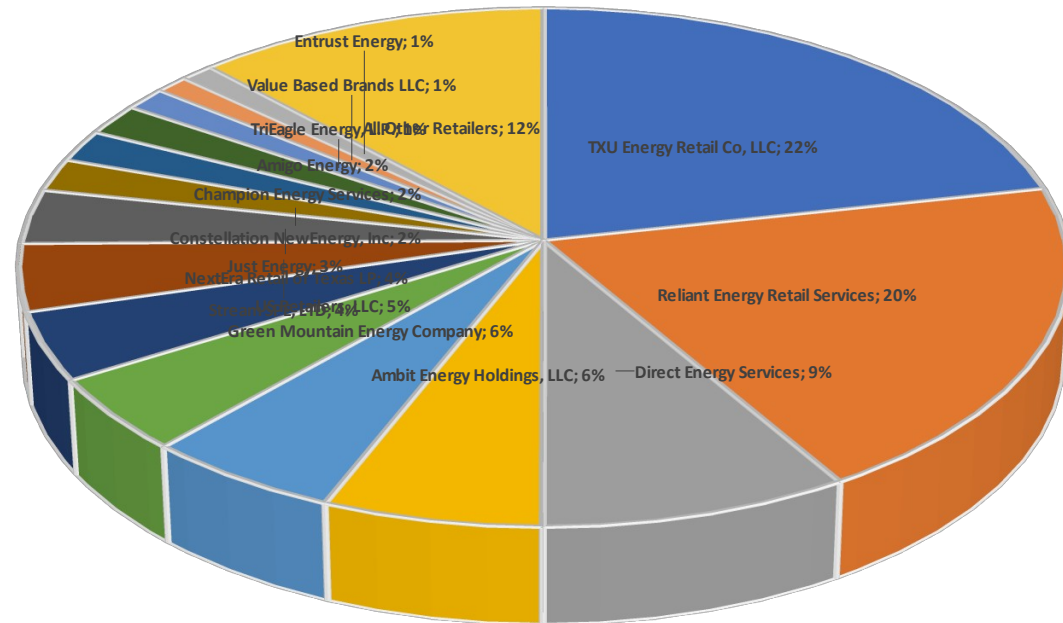
- Until recent years, over 100 Retail Electric Providers or 'REPs' served customers (including some industrial energy consumers that serve as their own REP).
- Service areas of investor-owned transmission and distribution utilities offer customer choice.



March 2003

Residential Retail Market Share in Areas Opened to Competition (based on customer counts)

Lots of competitive options, right?

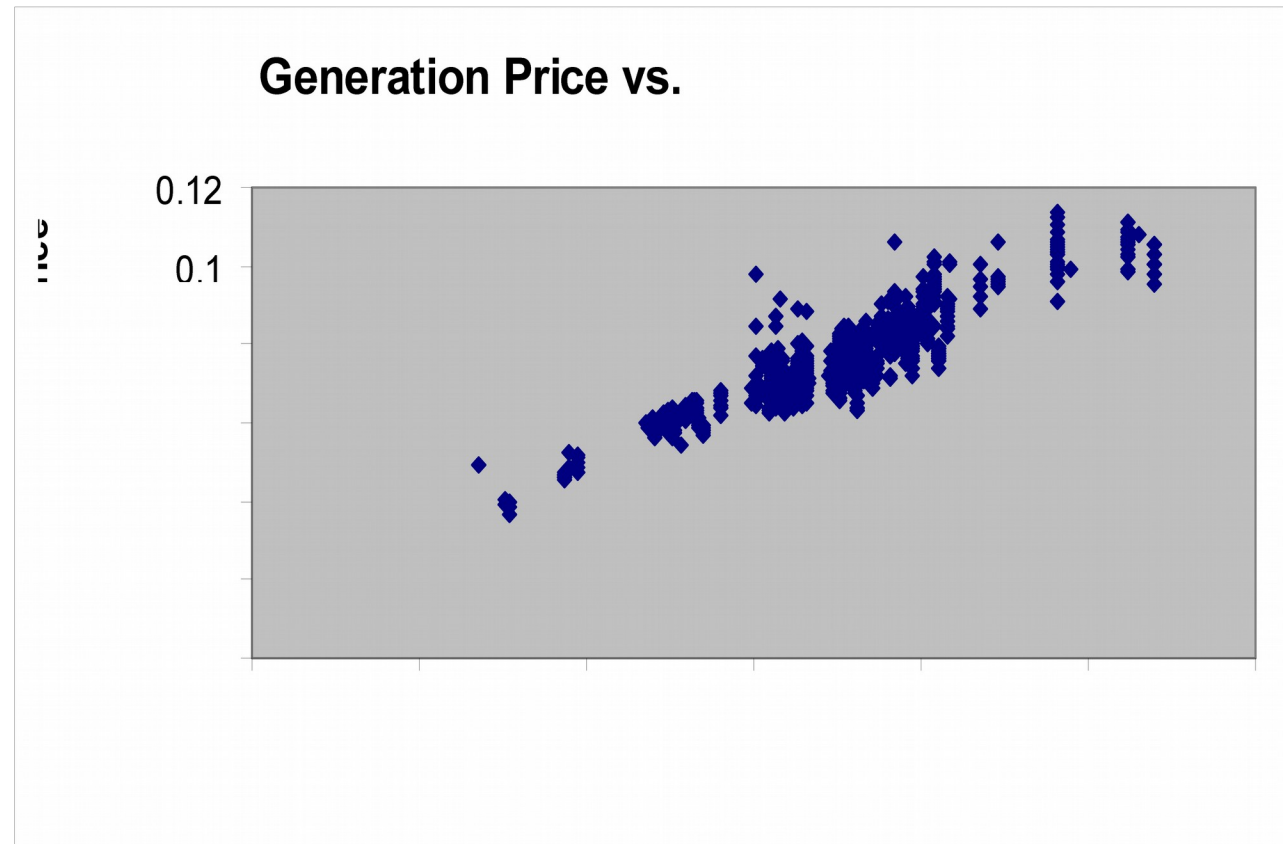


Source: D.P. Brown, C.H. Tsai, C.K. Woo, J. Zarnikau, S. Zhu, Residential electricity pricing in Texas' competitive retail market. *Energy Economics*, 2020.

Retail Market Concentration

- *Lots of competitive options? Well, not really, for residential consumers.*
- Many of the retailers on the previous chart are affiliates.
- Due to the merger of NRG Energy and Direct Energy, the HHI increased by 1,518 points to 3,186. Consequently, the residential sector – already moderately concentrated – entered the **highly-concentrated** range in January of 2021.
- NRG Energy and Vistra control more than 50% of the market share for all retail sales.
- Of particular concern, the acquisition resulted in a highly-concentrated *residential* market with two companies controlling nearly 78% of residential sales in Texas' areas opened to retail competition.
- See D.P. Brown, J. Zarnikau, P. Adib, C.H. Tsai, C.K. Woo, Rising market concentration in Texas' retail electricity market. *The Electricity Journal*, October 2020.

Restructuring has increased the sensitivity of retail electricity prices to the price of natural gas (the marginal fuel)

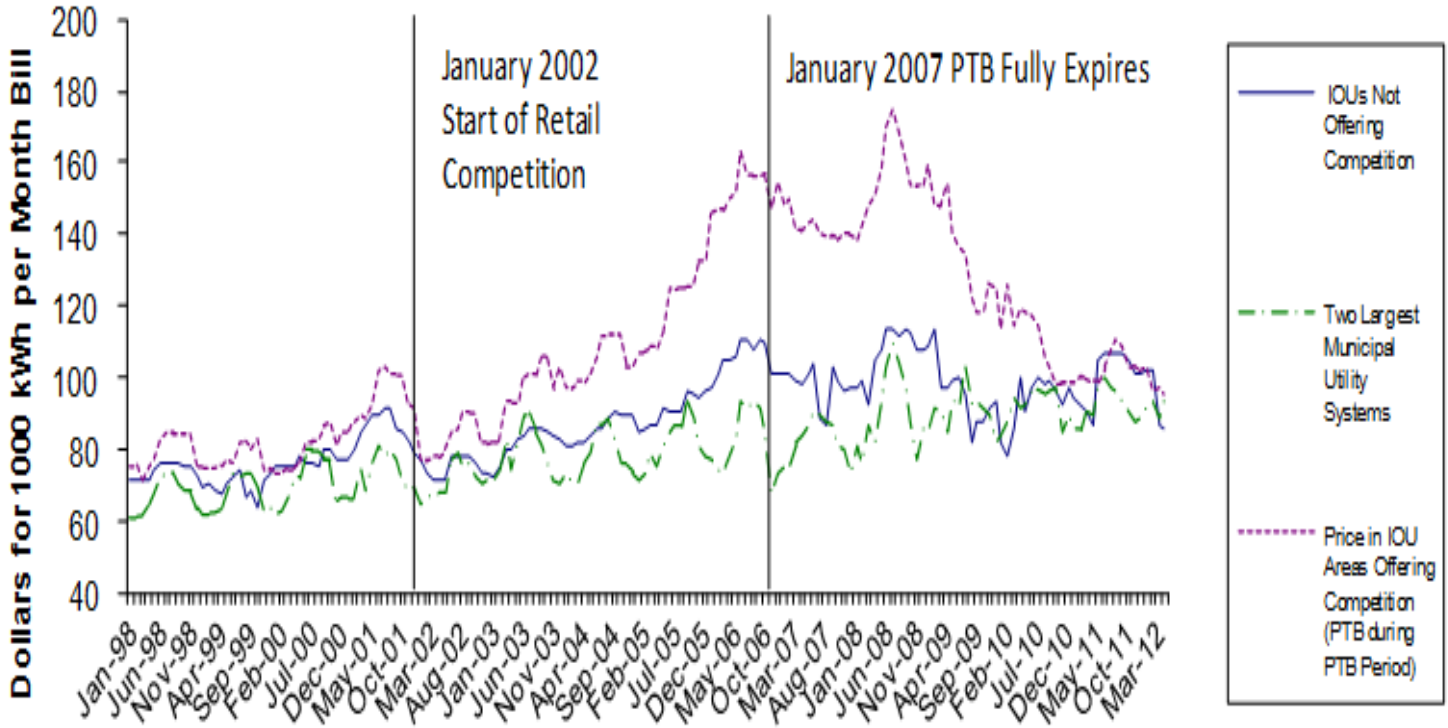


RESIDENTIAL PRICE TRENDS AMONG UTILITY GROUPS

Weighted Average of Prices Offered by Members in Each Group:
Only AREPs are Represented in Prices for IOU Areas offering Competition

When natural gas prices are low, restructuring looks like a great deal!

When gas prices are high, restructuring looks like disaster



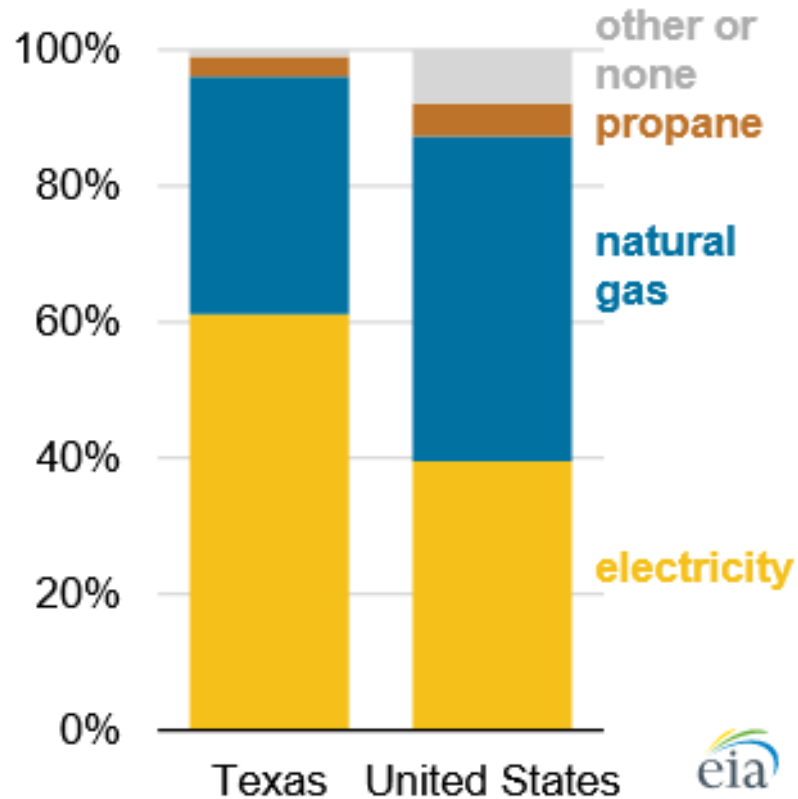
So, what happened after Valentines Day?

- Polar vortex, winter storm Uri
- 4.5 million Texas homes without power during peak outage time
- ~111 deaths
- An all-time peak in demand would have been reached, had there not been outages
- Water system problems
- State of emergency declared
- Coal piles freeze-up
- South Texas Nuclear Project Unit 1 is shut down after a sensor freezes
- Some wind turbines freeze and can't operate



Texans rely on electricity for home heating: So electricity demand surged

Primary home heating source (2019)
percentage of total



57 people die from hypothermia

So, what happened after Valentines Day?

- The natural gas supply system failed
 - Electric compressors in the gas pipelines need electricity
 - But the gas supply industry generally failed to register as critical electric infrastructure, and got curtailed
 - But, with no gas available, we lost a lot of natural gas power plants
- At one point, ERCOT lost 48% of its generation resources!!
- We were 4.5 minutes away from a cascading grid collapse.



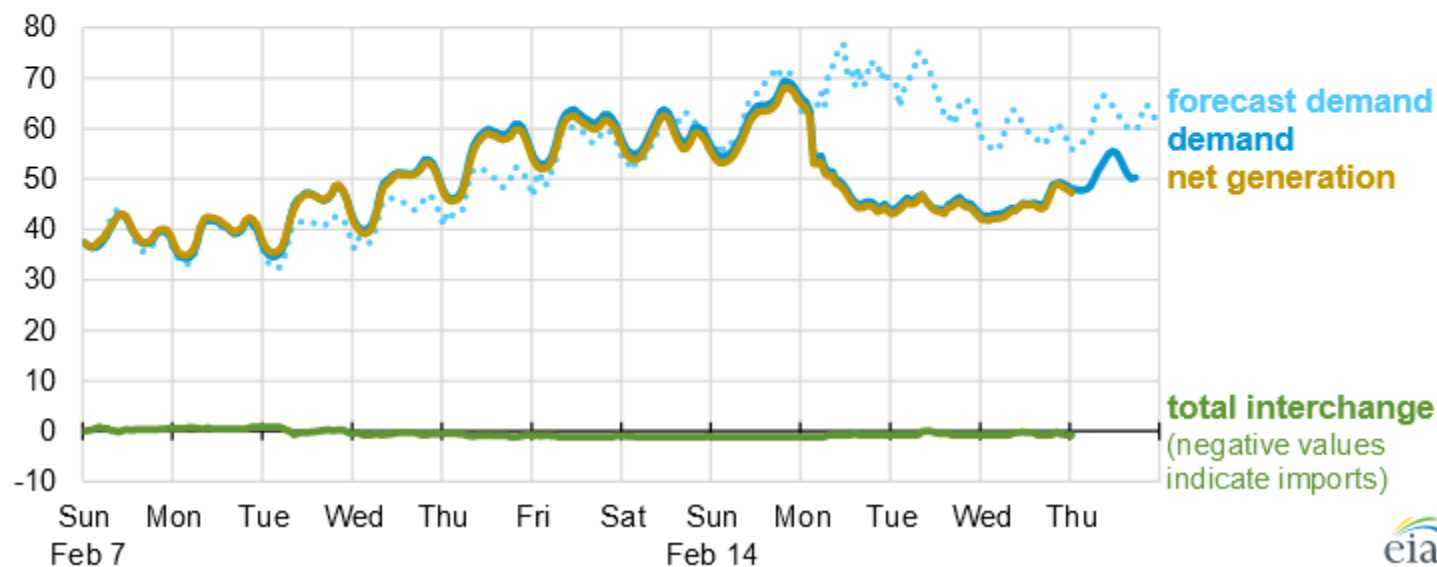
FEBRUARY 19, 2021

Extreme winter weather is disrupting energy supply and demand, particularly in Texas

Hourly electricity demand, net generation, and total interchange (Feb 7–Feb 18, 2021)

Electric Reliability Council of Texas, Inc (ERCOT)

gigawatts



Source: U.S. Energy Information Administration, [Hourly Electric Grid Monitor](#) (ERCOT demand, net generation, and interchange)

Electric Reliability Council of Texas, Inc. (ERCOT) electricity generation by energy source 2/13/2021 – 2/20/2021, Eastern Time



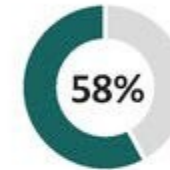
Source: U.S. Energy Information Administration

2021 Winter SARA

Seasonal Assessment of Resource Adequacy* (SARA) vs. Actual Generation

Performance vs. SARA

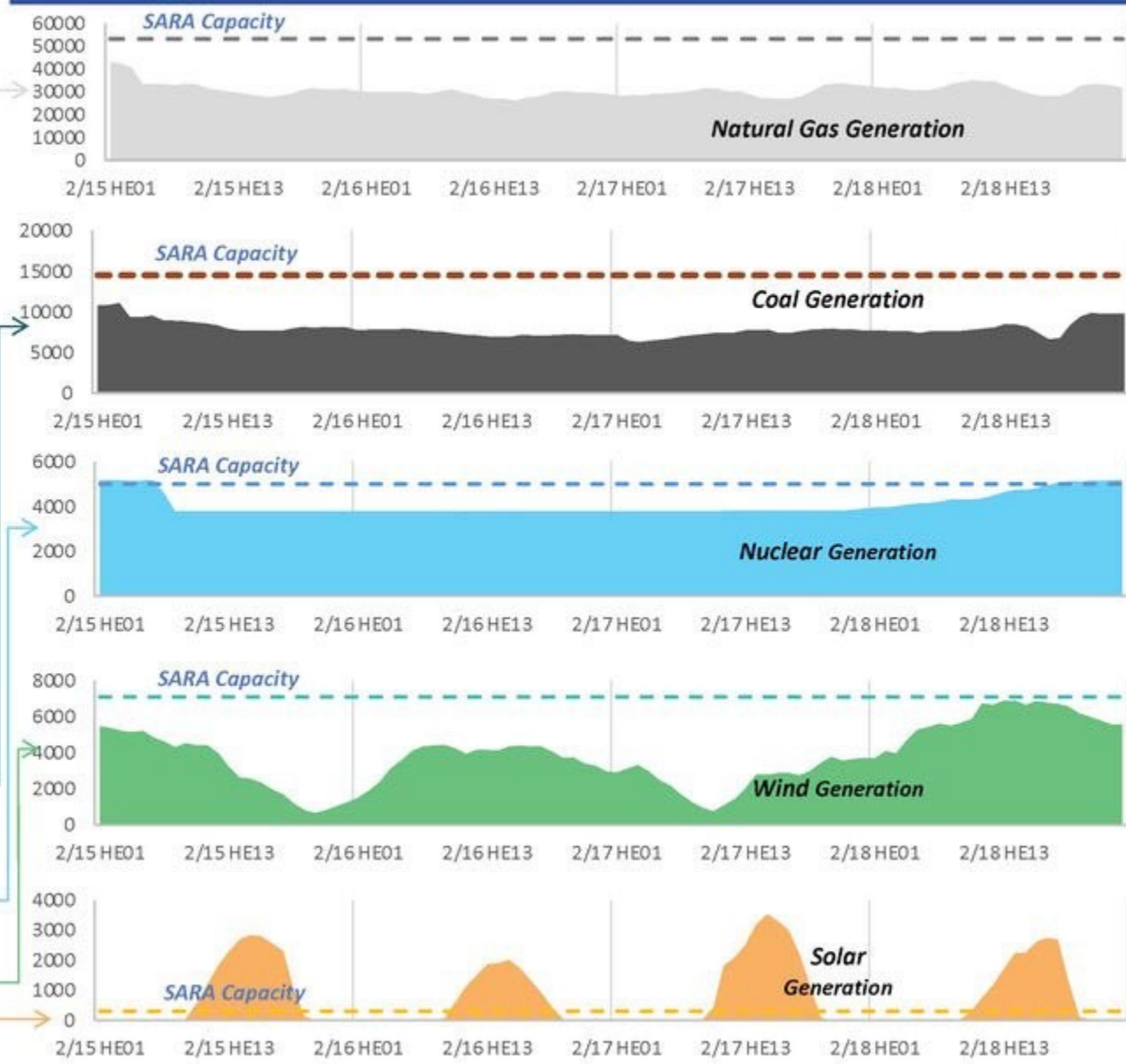
ERCOT Electricity Generation vs. Seasonal Expected Availability
Feb. 15-18



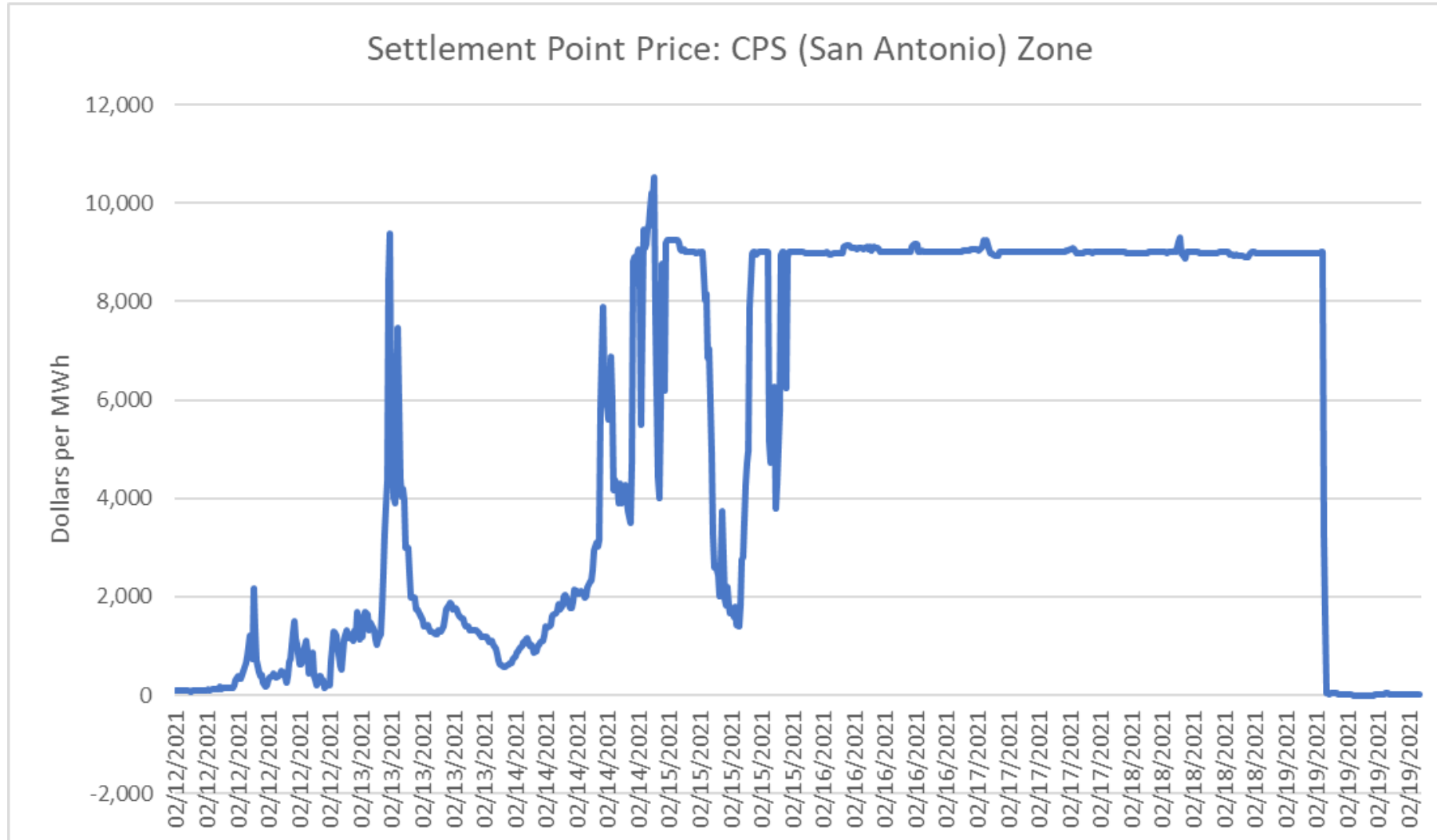
* ERCOT's Seasonal Assessment of Resource Adequacy (SARA) attributes an expected available capacity to each generation type, considering seasonal factors.

Data Sources:
[Winter '21 SARA](#)
[Daily Balancing Authority Report](#)

[†] During peak demand (18-23h)
Over all hours: 259%



Wholesale Market Prices



Fallout from the High Prices

- Brazo Electric Cooperative defaults and files for bankruptcy
- CPS Energy (San Antonio's municipal utility) reports losing over \$1 billion
- The two largest retailers, Vistra and NRG, reported losing a lot of money
- Small poorly-hedged retailers couldn't pay their bills to ERCOT, including Griddy, Entrust Energy, and Power of Texas Holdings.
- Many wind farm owners with "P99 hedging contracts" run into financial problems
- All PUC Commissioners leave (or will leave when a replacement is made). Half of ERCOT Board quits. ERCOT CEO is fired.

Where did
the money
go?



on facility in Texas. Plants owned by Temple and TexGen Power were able to sell electricity to power hundreds of thousands of homes during the storm.

By [Juliet Chung](#) and [Katherine Blunt](#) / Photographs by Julia Robinson for
The Wall Street Journal

April 6, 2021 5:30 am ET

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104 RESPONSES [💬](#)

A handful of Wall Street firms that bet big on the power sector in recent years made millions in paper profits when the [winter storm in Texas](#) boosted demand for the electricity generated by plants they own.

SoftBank Group Corp.'s Fortress Investment Group LLC and Kennedy Lewis Investment Management LLC, a \$3 billion credit hedge fund in New York, were two of the biggest winners in the trade. Other significant investors include Avenue Capital Group, Guggenheim Partners LLC, JPMorgan Chase & Co.'s asset-management arm and Pacific

Also, some natural gas
producers did very well.

The “Re-pricing” Issue

- The Independent Market Monitor questioned whether prices should have remained at the \$9,000 per MWh cap after the outages of service called by ERCOT ended.
- This prompted calls for re-pricing wholesale power for 32 hours, to reverse \$16 billion (or \$4.2 billion) in “over-charges.”
- The Texas Lt. Governor demands that the PUCT reverse the charges
- The Texas Senate passes a bill requiring “re-pricing.”
- But, the Texas House and the remaining PUCT Commissioner decline, citing that their Order to keep the prices high was rational and intentional – intended to encourage more supply to come on-line and price-curtail demand.
- Perhaps, in hindsight, this was an error in judgement by the PUCT and ERCOT. But, it wasn’t the type of unintentional error that there was precedent for reversing.

A whole new set of policy issues

- How can Texas ensure that generators are better-prepared for severe weather?
- How can the natural gas industry better-prepare for severe weather?
- How can communications between the natural gas and electricity industries be improved?
- How can communications to policy-makers and the public about electricity and natural gas system outages and other threats to the provision of utility services be improved?
- Should our regulatory system with different state agencies having responsibility for oversight over the electricity and natural gas industries be changed?
- Has Texas benefited from its restructured competitive electricity market?
- Are fundamental changes to the market structure needed to provide Texans with better electricity services?
- Has the restructured ERCOT market diminished the incentives to invest in resilient electricity generation sources?
- As the generation mix in Texas evolves toward greater dependence upon renewable energy sources, will reliability be affected?
- Do we need to re-visit generation adequacy targets? Is our present reliance on summer planning reserve margins appropriate?

A whole new set of policy issues

- Do we need a capacity market, resource adequacy requirements, a “resilience market,” or some other means of ensuring that generation adequacy targets are met?
- Will there be sufficient competition in the retail sector in the areas of the state opened to customer choice as the market becomes increasingly concentrated due to the default of smaller retailers and new barriers to entry in light of higher credit and collateral requirement resulting from the market impacts of the outages?
- Should we expect increasing volatility and a greater frequency of severe weather events in the future?
- Would greater investments in energy efficiency (particularly the weatherization of dwellings) improve safety and improve system reliability? (Presumably, it is easier to survive in a home without electricity if the home is properly sealed from the outdoor weather with better windows, caulking, better insulation, weather stripping, etc.)
- Should the state invest more in demand response
- Can AMI systems be used to “surgically” curtail customers and better-rotate outages? Or are there technical limits to the capabilities of those systems that must first be overcome? What would it take to overcome any technical limits?

A whole new set of policy issues

- Can our systems of determining who can be disconnected be improved – so that electric natural gas compressors are not disconnected and vulnerable people with health conditions are not disconnected?
- Should the Railroad Commission's prioritization of gas service during gas shortages be revisited?
- Does the use of interruptible gas contracts by peaking electric power plants need to change?
- Does ERCOT need more visibility into the fuel infrastructure (the natural gas supply system, coal transportation and mining systems)?

A whole new set of policy issues

- Should ERCOT be better interconnected with the Eastern or Western North American grids (and come under FERC jurisdiction).
- Are there means of improving ERCOT's ability to trade with other markets without jeopardizing the state's unique legal status as an intrastate market?
- To what degree can or should the State of Texas bail-out municipal utilities, rural electric cooperatives, and consumers who underwent financial distress as a result of the storm?
- Are the PUCT's scarcity pricing rules for ERCOT broken? If so, how should they be fixed?
- If the state prohibits variable pricing plans (e.g., Griddy's real-time pricing) how will consumers receive the price signals necessary to ensure that the demand side of ERCOT's market appropriately responds to system scarcity?



"Well, back to the old drawing board."

My thoughts: Winterization

- Obviously, we need to get the generation fleet and the natural gas system better-winterized.
 - I'd rather not see the State subsidize this
 - I think we can set and enforce standards for winterization
 - If you want to play in the state's markets, you need to meet the standards
 - The absence of standards – and reliance on the market – failed us here.



My thoughts: Reduce Price Volatility

- The volatility in wholesale prices is far too great.
 - Volatility increases the costs of financing resource investments and hedging. Volatility benefits speculators, but does it benefit consumers and the market?
 - In some years, generators can't cover their fixed costs. In other years, generator profits can be excessively-high (if they can keep their plants running).
 - We need to provide generators with a reasonable opportunity to recover their costs, including the cost of winterizing facilities to acceptable standards to ensure sufficient levels of investment. But electricity needs to be affordable.
 - Even if economists believe that a pure market solution is what we need, policy-maker in Texas do not. *Yes! Even in Texas.* So, we need a means of imposing reasonable upper and lower bounds on generator revenues over the long run.

My thoughts: Redesign Options

- There are many ways of reducing volatility in wholesale prices while encouraging investment without implementing a capacity market:
 - Impose strict year-round resource adequacy requirements upon load-serving entities and require all resources to meet resilience standards.
 - A regulatory agency certifies that the resource identified by the load-serving entity meets the standard.
 - Build upon what is done in the California, MISO and SPP markets
 - The price cap (and price volatility) can be lowered, since there will be fixed payments made from load-serving entities to resources, but there is not necessarily a need for centralized markets for capacity.
 - The Retailer Reliability Obligation (RRO) being implemented in Australia could serve as a model
 - If a resource deficiency is identified 3 or 1 years out, retailers would need to demonstrate that they can meet their share of system demand. Actions would be take if they can't.

My thoughts: Redesign Options

- Another approach
 - Adopt “priority pricing” or reliability-differentiation of service.
 - Provide consumers with a menu of service options, differentiated by level of firmness and price
 - Require load-serving entities to buy “tolling agreements” for thermal generation units which are dispatched by the ISO. Through a tolling agreement, a buyer will supply fuel to an electric generator and, in return, the generator will provide power to the buyer.
 - A load-serving entity that fails to bring ample resources to the market will be the first to suffer the consequences if aggregate resources prove to be inadequate

See: C.K. Woo, I. Milstein, A. Tishler, J. Zarnikau (2019). An efficient electricity market design *sans* missing money and price manipulation. *Energy Policy*. Vol. 134, November.

My thoughts: Electric/Gas coordination

- In Texas, the electric and natural gas industries are all part of the same system, and we need to treat them as such. This requires far greater coordination and communications among the two industries.
- Having different regulatory agencies over the two industries doesn't help with coordination.

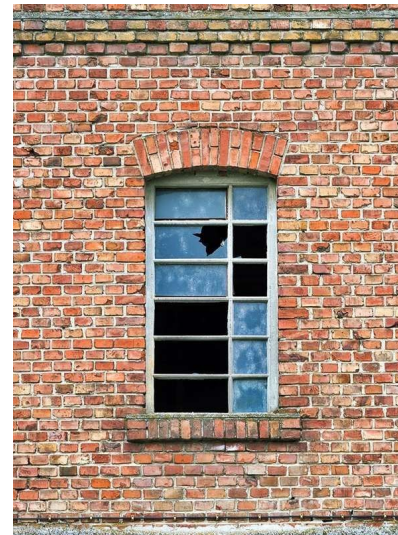
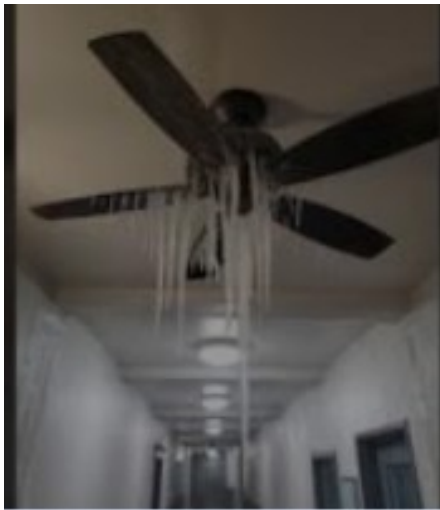


My thoughts: Demand Side focus

- More attention must be paid to fostering the response of the demand side of electricity markets to changes in the cost of generating, transmitting, and delivering power to the consumer.
 - Demand response is essential to the success of competitive electricity markets.
 - In markets with relaxed regulatory oversight, demand response can be used to help constrain prices to economically efficient levels.
 - A small amount of demand response can yield significant reductions in wholesale electricity prices.

My thoughts: Energy Efficiency can play a role

- You have a better chance of surviving a week of freezing winter weather or hot summer weather without electric service if your dwelling is well-built
 - Revisit building standards
 - Low income weatherization programs.



My thoughts: More Demand Response

- Many demand response programs in Texas are limited to the summer.
- More Winter DR programs could help – especially if they could be targeted toward low-priority end-uses (water heating, entertainment), improving the availability of electricity for home heating

My thoughts: Better price signals

- We need price signals
 - Outlawing variable rates is not the right direction.
 - Consumers need price signals to encourage response

Nonetheless, we also need to recognize that the supply side can't respond if there is no more supply available. Price signals might be of limited value in some situations. When this happens, we need to rely on quantity-rationing (curtailment schemes) – not price rationing.

My thoughts: Curtailment schemes

- Curtailment schemes need to be revisited.
 - My home lost power for three days due to “rotating” blackouts.
 - Many of my colleagues never lost power.
 - I know others who went without power for five days.
 - The practice of cutting-off power to entire distribution lines, sparing anyone on a line that has a single critical needs account, isn’t equitable.
 - Let’s explore strategies for “surgical curtailments.”
 - What needs to be done before we can use AMI for remote disconnect/reconnect during emergencies?

My thoughts: Better planning

- Our planning must improve
 - We need to plan for more extreme weather events



My thoughts: Interconnect ERCOT?

- The last time the interconnecting ERCOT with the Eastern grid was studied was by the Synchronous Interconnection Committee (SIC) in 1999.
- A lot of changed since that last study concluded the costs of interconnection would exceed the benefits.
- It is time to conduct another study.

My thoughts: Encourage more competition in the Retail Sector

- With recent defaults by small retailers, the retail sector is getting very concentrated.
- New higher credit and collateral requirements resulting from the persistent high prices in February will pose a barrier to entry for new retailers trying to enter the market.
- Legislation designed to restrict the pricing plans that can be offered by retailers will further stifle competition.
- An unregulated oligopoly seems unacceptable.
 - Should we impose some regulatory restrictions on retailers with high market share?
 - Or, should we focus on fostering competition in the retail market?

My thoughts: ERCOT Board

- Replacing the out-of-state Board members with Texas elected officials isn't the solution
- We need expertise in engineering, economics, planning, market design, and other technical specialties.

Questions?

