

HOW IT WORKS – THE POWER GRID SERVING MOST OF TEXAS, ENTITIES INVOLVED IN POWER, AND WHAT HAPPENED LAST WEEK

At the suggestion of some friends, I have attempted to explain the electric market structure and events of the past week below. I have no affiliation with any company or entity right now, having recently left a company that was acquired by a larger competitor. I resigned from the EROT Board last month as well, so I understand the inner workings of ERCOT, utilities, generators, retail providers, and the roles each play in our grid. My comments here should be as objective as you will see in any post.

Please disregard or scrutinize most of what you read in the press and on social media. Much of it is prepared by one interest or another and handed to media outlets. As an example, the claim that “wind is at fault” is simply untrue, although wind turbines have caused pricing issues for development of other types of power plants. Wind didn’t cause the outages, and neither did other forms of generation. They all had issues. Social media rants are understandably angry, but the rant is almost always inaccurate or blatantly false. Challenge accusations without substantiation. This is a critical topic for all of us. We need to make the right improvements.

Explaining a complex industry in a digestible form is very difficult, but here goes.

Texas lawmakers voted for a competitive market in 1999. The bill was bipartisan – D House and R Senate R Gov. That change in law altered the Texas electric landscape. Prior to 1999, ERCOT was a small entity with limited involvement. Utilities made most decisions, and the grid wasn’t as interconnected as it is today. After 1999, ERCOT’s role grew because the coordination between utilities was essential. New transmission lines were connected, allowing power to flow freely across the state. This facilitated incredible efficiencies in power delivery, and that was good for prices but also for the environment. Not only do the most fuel-efficient plants not run the most because they are cheapest but also burned the least amount of gas to produce the smallest emissions. The market structure was brilliant, and those who created it should take great pride in it. The world envies the Texas electric market structure, but it is not perfect as we know. Improvements are constant, and we are all embarking on the next series of improvements.

The primary purpose for competition was to make our electric service more economically efficient and reliable. Believe it or not after this past week, it is. ERCOT’s role is one of a coordinator and administrator. It communicates with utilities and generators 24/7 about the need for power, outages, etc... spanning almost the entire state. If one area of Texas experiences a hardship, ERCOT re-routes power or dispatches power from another area to compensate. Much of this is automated because of its scope and complexity. For example, a power plant tripping off in West Texas impacts the flow of power all over. Electrons are produced and consumed in the same moment, so power flow is instantaneous. Managing it is difficult to comprehend. The job requires hundreds of engineers, mathematicians, and physicists who ensure that it works. ERCOT cannot find enough advanced mathematicians in the US, so jobs are often filled by brilliant folks from other countries. There is nothing wrong

with this hiring; it makes possible every electric grid's flow of power across the country. Board members are sought from all over, mostly to inject ideas and experiences from other areas that may improve the Texas grid. But most Board members live and work in Texas because they are representatives of each segment of the business. The Board structure was carefully crafted, as was the working committee structure that handles the nuts and bolts of operational rules. ERCOT is an impressive body.

So – ERCOT doesn't own any generation, wires, meters, or any hardware that you see on the ground. ERCOT does not buy or sell power for utilities. It coordinates activities for those companies (or cities or cooperatives) who do. When a situation erupts like last week, ERCOT does the math. It figures out how much power is available and notifies the utilities what must be done to sustain the grid. ERCOT simply tells each utility how much power demand must be reduced, and each utility then decides how it will manage rolling brownouts. ERCOT does NOT make that decision.

What happened last week? ERCOT witnessed and prepared for last week as soon as a weather pattern in the Arctic was known. That's what they do. Forecasting models are run, what-ifs are done, planning occurs. They rely on modeling tools and historical precedent to make decisions. But the past week blew away any historical experience in terms of temperatures and duration and scope. This cold front was huge, cold, wet, and prolonged. Those are all bad things to occur when you must operate mechanical devices in those conditions. Air and auto traffic practically stopped. Meanwhile, ERCOT was attempting to determine how many generation units might be lost as a result of the weather. The front was so extreme that I believe that it exceeded all expectations. This was outside of anyone's forecasting. As a friend conveyed to me, nukes rarely trip for any reason, and the South Texas Plant lost one of two units due to the weather. That is extraordinary – and a loss of 1200 MWs you would expect to have. Gas-fired generation is basically a turbine engine like you see hung on an airplane wing, only larger. These are huge, complicated and temperamental devices. They can and did trip off because a single line (metal tube connecting components) or gauges froze. An entire unit shuts down in minutes because of a couple feet of tubing. Wind turbine blades froze, causing a large percentage of a huge fleet to shut down. Solar panels were covered in ice and snow and provide no power overnight (when the 1am Sunday problems began). Coal units are similar to gas units. So every form of power generation was impacted.

Compounding the electric problems were roadway, gas and water challenges. As roads iced and became impassable, crews could not respond to assist with problems. Gas wells froze. My brother is a lifelong Halliburton engineer who explained ice plugs to me. Gas underground has water (hydrates) in it and is under high pressure. As the gas is extracted, the pressure decreases. Lowering the pressure on gas causes the gas and water to chill, and a drop in pressure can cause an ice plug down in the hole or at the surface. So natural gas has challenges as well in cold temperatures. Water systems froze or were failing, and some power generation units rely on water for cooling. With the infrastructure failing at every turn, you can see why the outages we experienced were so much greater than expected.

Not only did we lose more power than anticipated, but we also consumed more power than expected before the outages began. So ERCOT had to notify utilities to begin the emergency outages quickly and appropriately.

Everything that could go wrong seemed to have gone wrong.

This leads to pricing of power, a complex subject unto itself. Electricity is traded, bought and sold on an exchange. ERCOT developed and manages the exchange for market participants like generators, retail providers, industrial customers, and traders. ERCOT does not trade and does not influence prices unless there is a shortage. This is important, so read carefully. When a scarcity event occurs – and that is specifically defined in ERCOT rules – ERCOT must follow a preset script for how pricing is determined. The scarcity levels and the prices are already determined for ERCOT. That script is tiered based on the amount of power reserves that remain. The less the reserves, the higher the price. Scarcity was so tight for days that the highest prices were required to be received by generators during the storm. These high prices do NOT benefit ERCOT at all. The purpose for the high prices is to provide the greatest incentive for generators to produce every megawatt they can, for large electric customers to shut down, and for all of us to conserve because it is the right thing to do.

Where I think you will see a good bit of discussion this week in hearings is to determine if that pricing mechanism worked properly. If all generation was online and big consumers had already shut off their demand, are the high prices still appropriate? That discussion is very important.

How were we impacted as residential consumers? Nearly all of us were unscathed by the spike in prices. Why? Because we purchase power on a fixed price basis from Austin Energy, Pedernales, or a competitive provider. We were protected from the spike. What was all the fuss about huge bills? The sensational news stories about \$17,000 power bills were perhaps true but overplayed and somewhat misleading. Let me explain why. As I read the story a few days ago, the customer with that whopper bill owned 3 houses. He was on a competitive provider called Griddy. Griddy is somewhat unique because its service is sold using the WHOLESALE price of power (the prices on the power exchange managed by ERCOT) plus the utility costs for wires and poles. Griddy charges a monthly fee to access this plan. Griddy prices are usually low, but a scarcity event like this one (and one that occurred a couple of years ago) drives the price into the stratosphere. Buyers of Griddy's plan are usually sophisticated energy people who understand it and can react to high prices. If you can shut down the power to your house during peak times, you can save money. If you cannot, you get hammered. The folks on Griddy were hammered. That was their choice, not something forced upon them. This will be a topic for discussion among lawmakers this week.

I hope this explanation offers some background for you to understand a bit about what will transpire this week and in the coming months. Everything is fair game for review. What do I think should be the focus of the hearings? Here's my list:

- Review ERCOT's series of actions to ensure the rulebook was followed. I expect this to show that they acted prudently.
- Review utilities' actions when implementing outages. I expect a lot of questions and possible changes to the methods employed for rolling outages. In competitive areas of the state, customers are turned on and off every day as they move in and out, fail to pay bills etc.... So the utilities have the ability to control power flow by the meter. That would yield a much more equitable result for outages – that is, to spread the outages across a broader population so that no household is cut off for more than a minimum amount of time.
- Review generator preparedness and weatherization actions – this will include all improvements made since the 2011 freeze. I know some improvements were made by some companies but did not prevent trips at those plants. So there will be pressure to do more.
- Review gas well and gas pipeline freezes and prevention – this will be an interesting discussion involving the Railroad Commission.
- Review steps taken by wind farm operators to de-freeze turbines.
- Review what, if anything, can be done to prevent solar panel loss of power.
- Discuss installation of electric storage facilities across the state – the economics of massive battery installations may stall this. If huge battery arrays are economical, then competitive developers would be working on them already. This may be a promising component for all of us in the future, but it has its own challenges.
- Discuss water and roadway challenges.
- Discuss localized outages caused by vegetation management (read: tree) problems.
- Review impacts to consumers, including Griddy's pricing plan (already announces as part of the investigation).

I appreciate your time to read this short summary and encourage you to seek reliable resources to learn more. There are many nuances to what I encapsulated above. This is a very simplistic explanation of a complex business.