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ENABLING AND BENEFITING FROM DISTRIBUTED ENERGY RESOURCES IN TEXAS

By Christopher Villarreal

INTRODUCTION

After the passage of SB 7 in 1999—which deregulated the electricity market for most of the state—Texas has been a leader in the electricity industry. Currently, it is one of the leading states in installed capacity for wind energy, and has the most robust energy choice market across the United States. By deregulating electricity for most of the state, Texas has ensured that its residents continue to be served by highly reliable and low-cost electricity, which includes some of the most innovative rate design options for electricity customers. The Electric Reliability Council of Texas (ERCOT), which is the wholesale market and transmission operator for the deregulated portion of Texas, manages an increasingly diverse electricity mix built on wind, natural gas and solar.

In the current system, electric utilities maintain the poles and wires of the electricity system, which leaves the retail choice market free to innovate new products and services. As a result, the ERCOT can develop new market opportunities for those products and services. Nevertheless, with Texas' focus on the ERCOT market, those products and services have focused primarily on that market leaving the distribution system in the hands of the distribution utilities. With the growth of distributed energy resources (DER), Texas will need to pay greater attention to the opportunities DER can provide. For example, solar and electric vehicles (EVs) are expected to continue to grow across the ERCOT territory, which will put a new focus on the distribution system. For the non-ERCOT portion of Texas—which remains served by vertically integrated utilities—the opportunities for DER will also be available to customers. This paper will outline several steps that will allow Texas to take better advantage of these new resources, enable new markets for products and services, and maintain its spot as a leader in electricity policy.

BACKGROUND ON THE TEXAS MARKET

The Texas electricity system is multifaceted. The lion's share of the attention paid to its electrical market focuses on features that are different from most other jurisdictions, such as the availability of choice and competition in the retail and generation markets in the ERCOT region or the fact that much of the state operates under its own independent electric grid.[1] Yet, the regulatory system is not uniform throughout the state and some parts of the system still look like what you would find in many other states. To understand the way electricity in Texas operates and how DERs fit into that picture, it is appropriate to conceptually divide the state's electric system into its component parts.

1. See, e.g., 16 U.S.C. § 824(b)(1).

The first division is between parts of the state inside and outside of the Texas Interconnect. As noted above, Texas has its own independent electric grid, which is managed by the ERCOT and covers approximately 90 percent of the state's electric load. Areas of the state outside of the ERCOT remain vertically integrated and do not allow competition for generation, transmission or distribution of electricity. Electric generation is open for competition within the ERCOT through an auction system. Most customers within the region also have the ability to choose their electric provider and different marketers compete on price and other service features. However, a handful of municipally owned utilities and electric co-operatives remain within the ERCOT and have exercised the option to not allow retail choice within their service territory. Customers in these jurisdictions still only have one option for an electric provider. Figure 1 below highlights the areas within the ERCOT in blue.

FIGURE 1: REPRESENTATION OF THE ERCOT REGION

SOURCE: "Fact Sheet," ERCOT, August 2020. http://www.ercot.com/content/wcm/lists/197391/ERCOT_Fact_Sheet_8.11.20.pdf.

While the market for generation and sale of electricity in most of the ERCOT is wide open, transmission and distribution are another story. Transmission and Delivery Service Providers (TDSPs) are responsible for the poles and wires of the electric system. They ensure that electricity can be safely delivered to your home, maintain and repair lines, and read meters. TDSPs remain regulated monopoly entities, and all customers receive the same services through their designated TDSP.[2] In competitive areas, there is a strict separation between the companies that market power and TDSPs. Decisions about the construction of new transmission are made upon application to the state's Public Utility Commission (PUC), which also provides traditional oversight for the state's monopoly electric utilities. In addition, the PUC ensures the requirements for systemwide reliability.

Therefore, system planning occurs at multiple levels and is undertaken by a variety of organizations and agencies. The ERCOT is responsible for managing the wholesale market in its region, which includes ensuring sufficient energy is available to meet demand.[3] It runs the wholesale market, akin to other Regional Transmission Organizations (RTOs) such as the Midcontinent Independent System Operator or the Southwest Power Pool. Distribution, on the other hand, is not run by the ERCOT, remains within the authority of the TDSPs and remains subject to oversight by the PUC. This distinction is important as regulation of the distribution system applies across the state, regardless of whether it is inside or outside of the ERCOT region.

DISTRIBUTED ENERGY RESOURCES

Distributed energy resources (DER) include all resources located on the distribution system, rather than those that come from large power plants. These can be behind-the-meter or front-of-meter resources. The National Association of Regulatory Utility Commissioners (NARUC) defines DER as:

> [A] resource sited close to customers that can provide all or some of their immediate electric and power needs and can also be used by the system to either reduce demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load. Examples of different types of DER include solar photovoltaic (PV), wind, combined heat and power (CHP), energy storage, demand response (DR), electric vehicles (EVs), microgrids, and energy efficiency (EE).[4]

More recently, Order No. 2222 from the Federal Energy Regulatory Commission (FERC) described DER as:

> any resource located on the distribution system, any subsystem thereof or behind a customer meter.' These resources may include, but are not limited to, resources that are in front of and behind the customer

2. Power to Choose, "FAQs," Public Utilities Commission of Texas, last accessed Oct. 23, 2020. http://www.powertochoose.org/en-us/Content/Resource/FAQ.

3. "Fact Sheet," ERCOT, August 2020. http://www.ercot.com/content/wcm/lists/197391/ERCOT_Fact_Sheet_8.11.20.pdf.

4. *Distributed Energy Resources Rate Design and Compensation: A Manual Prepared by the NARUC Staff Subcommittee on Rate Design*, National Association of Regulatory Utility Commissioners, November 2016, p. 45. https://pubs.naruc.org/pub/19FDF48B-AA57-5160-DBA1-BE2E9C2F7EA0.

meter, electric storage resources, intermittent generation, distributed generation, demand response, energy efficiency, thermal storage, and electric vehicles and their supply equipment—as long as such a resource is 'located on the distribution system, any subsystem thereof or behind a customer meter.'[5]

While the ERCOT is not subject to FERC jurisdiction, these definitions show that DER is more than just rooftop solar and includes other resources like energy efficiency, demand response and electric vehicles. By including these resources in the definition, it expands the benefits and uses of these technologies, but also envisions opportunities where a mix of these technologies can be bundled and offered as a portfolio of solutions. For example, storage and demand response can be paired to defer investments in distribution infrastructure. Furthermore, with the growth of rooftop solar, the advanced inverter can be utilized to minimize voltage disturbances on the distribution system which might have been addressed by utility infrastructure instead.

Looking at the ERCOT, the three largest resources seeking interconnection through September 2020 are solar (77,000 megawatts (MW)), wind (24,000 MW) and battery storage (18,000 MW).[6] All told, 126,000 MWs are at some stage in the interconnection process—119,000 MWs of that are solar, wind and battery storage.[7] While wind has been a mainstay of the ERCOT and Texas region for years, solar and battery storage are increasing in their adoption rates.[8] Importantly, this only tells us the story of those resources seeking to interconnect at the wholesale level, and does not describe what is occurring at the retail or distribution level.

Benefits and Uses of DER

By locating resources, like DER, close to customer load and connected to the distribution system, these resources can provide benefits to the distribution system and directly to the customer. Resources like storage, solar and energy efficiency can help the customer better manage their energy consumption and avoid using more electricity from their provider at their higher retail rate. Additionally, use of those resources means that the TDSP or the retail electric provider does not need to purchase that amount of electricity from generators, thereby lowering their costs and wholesale market costs. When bundled together, DER can be used to avoid or defer infrastructure costs, such as building a new distribution feeder or upgrading substations. These non-wires alternatives (NWAs) are being looked at around the country as options for distribution utilities to consider instead of installing new equipment at a location.[9] All told, DER provides utilities with greater flexibility to meet future system needs.

> Despite being restructured and open to competition in the ERCOT territory, Texas' TDSPs face a similar challenge in relation to DER as other utilities, regardless of market structure. For example, distribution utilities, like Oncor, earn a return on capital infrastructure. So, even though Oncor does not own generation, they still own the poles and wires. This means that when considering investment options, they will typically choose capital infrastructure over other projects that do not earn a return. DER may exacerbate this condition by providing customers with the ability to not only reduce their own consumption, but be considered as an option to avoid new capital projects entirely, which would reduce the amount of capital infrastructure, and, by definition, their return on equity.

Additionally, by using cleaner resources or avoiding or shifting consumption to other times during the day where renewables may be the marginal unit, DER is lowering wholesale energy costs in the ERCOT market and reducing overall emissions across the state. These emission reductions can be done locally—through energy storage, energy efficiency or solar—or via the ERCOT market through wind and demand response reductions. These all lower costs to the customer, the utility and the market. By creating an environment where DER and their developers can participate in markets—both wholesale and retail—Texas can maintain its leadership.

ACTIONS AT THE DISTRIBUTION LEVEL

In order to allow DER to realize these benefits, the PUC should consider several options that support customer choice, market innovation and lower costs to customers and the system. These actions should not require additional legislative direction and are within the purview of existing PUC activities. In addition, many of these actions are already in use in other states, which means Texas can take advantage of the lessons learned in those areas when designing its own

5. Federal Energy Regulatory Commission, *Order Number 2222: Participation of Distributed Energy Resource Aggregations in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Docket No. RM18-9-000, 172 FERC ¶ 61,247, September 17, 2020, at P 114. https://ferc.gov/sites/default/files/2020-09/E-1_0.pdf.

6. "Monthly Generator Interconnection Status Reports: September 2020," ERCOT, Aug. 31, 2020. http://mis.ercot.com/misapp/GetReports.do?reportTypeId=15933&reportTitle=GIS%20Report&showHTMLView=&mimicKey.

7. Ibid.

8. Joshua Rhodes, "Even Renewables are Bigger in Texas," *Forbes*, Sept. 25, 2020. https://www.forbes.com/sites/joshuarhodes/2020/09/25/even-renewables-are-bigger-in-texas.

9. See, e.g, Mark Dyson et al., "The Non-Wires Solutions Implementation Playbook: A Practical Guide for Regulators, Utilities, and Developers," Rocky Mountain Institute, 2018. https://rmi.org/wp-content/uploads/2018/12/rmi-nonwires-report-key-takeaways.pdf; Lisa Cohn, "What are Non-Wires Alternatives?", Microgrid Knowledge, June 21, 2019. https://microgridknowledge.com/non-wires-alternatives-are.

solutions. Lastly, each of these actions can work in conjunction with each other or can be done on their own.

Distribution System Planning

For the most part, all distribution utilities engage in some form of distribution planning. Utilities typically plan 2-10 years into the future and try to identify locations where infrastructure will need to be replaced or added, or where infrastructure is approaching the end of its useful life. For utilities that are subject to state commission authority, these processes are fully within the distribution utility actions and are subject to state oversight. The infrastructure and investment costs are then subject to state commission approval in a rate case proceeding. The utility filing identifies the budget, the spend in each budget and a request for the state commission to approve those budgets. Generally, state commissions look at budgets in total, and do not typically investigate the utility's distribution system planning efforts that led to the identification of budgets and programs for recovery via a rate case. Distribution system planning efforts around the country seek to formalize the utility's distribution system planning process, to provide more transparency so that the state commission, consumer advocates and other groups can identify where costs are appropriate, where plans may need to change and how the utility is looking at the future. This future underpins the entirety of the utility's distribution plan.

For example, Xcel Minnesota identified the types of investments it needs in the short, medium and long-term in order to maintain the distribution system in advance of the growth of DER—notably solar, EVs and energy storage.[10] Without these types of investments, it may be more difficult for the distribution utility to identify those technologies, potentially control those technologies, have visibility into the distribution system in order to operate the system effectively, and integrate those technologies and their associated services into their operations. This is a multi-year process where the regulator, and other stakeholders, ensure that the utility has a plan, has identified the necessary technologies, has a reasonable timeline for implementation and has explained the reasoning behind those decisions and the resultant costs. To reiterate, the most fundamental purpose for distribution system planning is to bring visibility into existing utility practices that are have heretofore been locked in a black box.

However, distribution system planning serves another purpose: laying the foundation for the future distribution system in the face of changes to customer demand and the system as a whole. To help state regulators prepare policies and better understand the planning, objectives and goals for the future of the distribution system, the U.S. Department of Energy (DOE) initiated the Modern Distribution Grid Project.[11] This project also seeks to minimize or eliminate embedded utility siloes that may act as barriers to DER expansion.

An example of the need for better planning in response to DER was provided by Oncor in their comments to the PUC's EV docket (Project No. 49125). In their comments, Oncor described a future scenario of greater amounts of electrified fleet vehicles. According to Oncor:

> While a single such load would likely not present major problems, truck fleet owners tend to be located in relative proximity to each other in warehouse distribution areas, such as near Alliance Airport, near DFW Airport, and in the southern Dallas intermodal area, for example. As these fleets are electrified over the next 3-10 years, significant upgrades to Oncor's distribution and/or transmission system may be necessary.[12]

What Oncor describes here is a clear example of the need for better distribution planning that includes a detailed understanding of a utility's forecast, including the adoption rate of DER. In order to maintain sufficient infrastructure to meet future customer demand, Oncor anticipates the need to invest in a significant amount of infrastructure (*i.e.*, poles and wires) to serve that demand.[13] This requires a distribution system planning process that provides more transparency into those utility plans, greater understanding of changes to customer usage patterns to support those infrastructure needs and an understanding of utility forecasts for customer demand and DER adoption.

Hosting Capacity

According to the Electric Power Research Institute (EPRI): "Hosting Capacity is the amount of DER that can be accommodated without adversely impacting power quality or reliability under current configurations and without requiring infrastructure upgrades."[14] This information provides the utility, and developers, with a sense of how much DER—solar in particular—can be added at a specific location before new infrastructure is needed to accommodate that added gen-

10. "Integrated Distribution Plan (2019-2028): Advancing the Grid at the Speed of Value," Xcel Energy, Docket No. E002/CI-18-251, Nov. 1, 2018. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E098D466-0000-C319-8EF6-08D47888D999}&documentTitle=201811-147534-01.

11. Office of Electricity Delivery and Energy Reliability, "Modern Distribution Grid Project," U.S. Dept. of Energy, October 2020. https://gridarchitecture.pnnl.gov/modern-grid-distribution-project.aspx.

12. "Oncor Electric Delivery Company LLC's Response to Questions," *Review of Issues Relating to Electric Vehicles*, Public Utility Commission of Texas Project No. 49125, Aug. 28, 2020, p. 3. http://interchange.puc.texas.gov/Documents/49125_49_1083363.PDF.

13. Ibid.

14. "Distribution Feeder Hosting Capacity: What Matters When Planning for DER?", Electric Power Research Institute, April 15, 2015, p. 2. https://www.epri.com/research/products/000000003002004777.

eration. Therefore, hosting capacity is increasingly vital to the development of distribution solar and storage markets as it provides the market with an identification of areas with available capacity which may result in a greater likelihood of successfully interconnecting. Available capacity is not a guarantee that those projects will be able to interconnect, but it provides information that is not otherwise available to the market.

Similar to distribution system planning, hosting capacity has historically been kept within the confines of the distribution utility. Without access to hosting capacity information, the market and developers are reliant upon the interconnection process to determine feasibility, which increases costs to developers and the utility. Making hosting capacity information available to the public and the market is a win-win situation where utilities can focus their workload and employee hours on more feasible projects and developers can better manage their capital and risk by first identifying areas with available hosting capacity and concentrate on developing projects in those areas.

As noted above in the distribution system planning discussion, hosting capacity can be used not only to support the market development of DER, but can be used by the utility for its distribution system planning. For example, a utility could identify an area in need of an upgrade, areas where non-wires alternatives may be appropriate or areas where a utility may want to target their own programs, such as energy efficiency. As utilities look to use their capital budgets in more efficient ways, using hosting capacity analysis could help them plan their system and ensure they have the appropriate infrastructure in place.

Interconnection

With increasing amounts of DER—in particular distribution-level solar and energy storage—it will be important for Texas to have up-to-date interconnection rules and practices. The PUC last updated its interconnection tariff in 2017, however, it has not updated its technical requirement document since 1999.[15] With the completion of the update to the Institute of Electrical and Electronics Engineers (IEEE) 1547 and UL 1741, there are significant new capabilities that Texas should evaluate. Notably, IEEE 1547 now allows for the use of advanced inverter functionality from solar installations.[16] The advanced inverter is a piece of software that can be used to manage voltage and current fluctuations at the source before electricity is sent out into the distribution system, or ride-through voltage imbalances without shutting down. With the additional communications capabilities identified in 1547, the advanced inverter can re-direct power flow back into the house or battery in the case of an outage. Prior versions of 1547 explicitly prohibited this function (anti-islanding) as a safety risk to utility workers.[17]

At its Winter 2020 meeting, the NARUC passed a resolution that recommended:

> State commissions, consistent with the practices and procedures of that State, convene proceedings that engage stakeholders soon; utilize existing research and experience and make evidence-based decisions to adopt the current IEEE 1547; and align implementation of the standard with the availability of certified equipment.[18]

The NARUC resolution identifies the role of state commissions in ensuring safe and reliable electricity, and that DER is continuing to proliferate. As such, the NARUC resolution notes that ensuring that utility standards are up-to-date is an important component of the regulator's job.[19] In addition, it is necessary for the state regulator to ensure that the states' interconnection rules and processes are in line with the new requirements outlined in IEEE 1547.[20]

Information available to the distribution utility from the interconnection process can also be used to identify areas where solar resources are seeking interconnection at greater numbers than anticipated. For example, solar tends to cluster, so information the utility receives from the interconnection process can be used to identify adoption rates, locations and types of resources. This information can then be used by the utility to improve distribution system planning. Furthermore, by utilizing the new functionalities enabled by IEEE 1547, rather than relying upon the distribution system to provide voltage support, the solar (or solar and battery) can provide voltage and VAR support on-site, which results in cost savings to the utility.[21]

DISTRIBUTION LEVEL MARKETS

The ERCOT market is an energy-only market, which means that energy and capacity prices are rolled into one "energy-only" price. In some circumstances, that results in very high prices in order to incentivize investment and development

15. P.U.C. Subst. R. § 25.211; P.U.C. Subst. R. § 25.212.

16. Charlie Vartanian, "IEEE 1547-2018 Revision Overview, with Additional ES Considerations," Sheraton Kona: NELHA Second Conference on Energy Storage Trends and Opportunities, Dec. 5-6, 2018. https://nelha.hawaii.gov/wp-content/uploads/2018/12/20.-Charlie-Vartanian_PNNL.pdf.

17. Ibid.

18. "Resolution Recommending State Commissions Act to Adopt and Implement Distributed Energy Resource Standard IEEE 1547-2018," National Association of Regulatory Utility Commissioners, Feb. 12, 2020. https://pubs.naruc.org/pub/E86EF74B-155D-0A36-3138-B1A08D20E52B.

19. Ibid.

20. Ibid.

21. Ibid.

of new product offerings, such as demand response. Similarly, with the growth of DER and the investments required in response, distribution level markets may be an option for Texas to consider. Non-wires alternatives—where the utility uses solutions other than utility capital to meet an infrastructure need—are being considered across the country by state commissions.[22] For example, if a utility identifies a substation that will need an upgrade in five years due to load growth, that utility may choose to invest new capital to build out that substation. On the other hand, a utility—at the direction of the PUC—may choose to procure other resources such as energy efficiency, demand response, distributed generation and energy storage to lower customer demand during certain time periods and compensate those customers for their response. This would allow utilities to defer investment into the future, which saves customers money by avoiding a utility capital investment. An example of this is the Brooklyn-Queens Demand Management project where ConEd used a portfolio of DER to defer a $1.2 billion substation investment.[23]

Currently, Texas is a leader in customer energy usage data availability via Smart Meter Texas, but more can be done with customer energy usage data through the development of these distribution level markets. Customer energy usage data will be vital to ensure customers receive benefits from their actions, assess whether they responded according to the expectations, to develop new products and services, or to assist customers with understanding potential savings and benefits of new DER offerings. Since Texas does not have a net energy metering tariff in place, Texas will need to be more innovative in compensating these resources for the services they provide. Customer energy usage data will be important to that development.

CONCLUSION

At the end of the day, the regulatory goal for the distribution system should be to focus on efficiency and optimization of all resources available to the distribution and wholesale operators. Increasingly, many of those resources and services are going to be located on the distribution system. This evolution will not happen in a day, but will happen—slowly at first, then at an advanced pace as the technology matures and costs continue to decline. Ensuring that Texas has the policies in place to best take advantage of these solutions will keep it as a leader in electricity policy and practices across the United States. As the role of DER continues to grow, more benefits will be enabled by better utilization of those resources. As customers and the market continue to invest their own money into these technologies, it will be possible to leverage those technologies at a lower cost, since the utility will not need to invest in them as well. Distribution system planning, hosting capacity and updating interconnection policy are three key steps that Texas can take today that will put them on a pathway toward a more efficient and optimized system that uses customer-sited resources as a solution and not as a problem.

As Texas looks to the future, DER can be utilized in a more strategic manner than it has in the past. Texas utilities recognize the importance that DER will play in the future, and the need for better distribution system planning guidance.[24] The data that utilities use for their distribution system planning process will be valuable to the market to understand utility investment practices, and provide an opportunity for the use of non-wires alternatives as a means to realize the benefits of DER to the system, customers and society. Distribution system planning—along with hosting capacity and updated interconnection practices—is part of the fundamental role of the regulator to ensure safe and reliable electricity is delivered at a reasonable price. If a utility over-invests in the distribution system when it could have leveraged non-utility assets, then customers overpay. If utility planning practices are not in alignment, then a utility could build a transmission line when a more local solution was available, thereby increasing costs to the customer. If developers do not know where the optimal locations for new solar or storage projects are, then they have to spend more than necessary and utilities have to work more than necessary when a map could have told the developer where there was available capacity. Lastly, without updated interconnection tariffs, the use of advanced inverters could result in a utility investing in more technology than needed to solve a distribution problem that could have been handled before the electrons hit the distribution wires. These are all reflections of the historical perspective of focusing on utility costs and investments; however, focusing on the development of distribution markets and making information about the distribution system available can result in a more efficient and optimized system, which will benefit utilities, customers and the Texas market.

ABOUT THE AUTHOR

Christopher Villarreal is an associate fellow in the Energy Policy division of the R Street Institute. His work focuses on policy and regulatory guidance on matters relating to distributed energy resources, grid modernization, performance-based ratemaking and distribution system planning.

22. Rhodes. https://www.forbes.com/sites/joshuarhodes/2020/09/25/even-renewables-are-bigger-in-texas.

23. Robert Walton, "Straight Outta BQDM: Consolidated Edison looks to expand its non-wires approach," UtilityDive, July 19, 2017. https://www.utilitydive.com/news/straight-outta-bqdm-consolidated-edison-looks-to-expand-its-non-wires-appr/447433.

24. "Oncor Electric Delivery Company LLC's Response to Questions." http://interchange.puc.texas.gov/Documents/49125_49_1083363.PDF.