COME AND CHARGE IT: THE RISE OF UTILITY-SCALE BATTERY ENERGY STORAGE IN TEXAS

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Affordable, reliable battery energy storage has long been the holy grail of the electric grid. From avoiding expensive transmission build-out to smoothing out fluctuations inherent to wind and solar resource output, batteries hold the promise of providing the solution to an ever more intermittent and distributed grid. Across the United States and particularly in Texas, that futuristic vision is beginning to approach reality as battery costs decline[2] and favorable regulatory policy is implemented.[3] This Article addresses the current state of battery energy storage system development and notes recent contributory policy developments at both the national and state level.

I. BY THE NUMBERS

According to the United States Energy Information Administration ("EIA"), as of March 2019, the United States had 899 megawatts ("MW") of operating utility-scale battery storage power capacity[4] and over 1,236 megawatt hours ("MWh") of battery energy capacity.[5] This installed capacity represents a nearly fourfold increase

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2. *See* RAN FU, TIMOTHY REMO & ROBERT MARGOLIS, NAT'L RENEWABLE ENERGY LAB., 2018 U.S. UTILITY-SCALE PHOTOVOLTAICS-PLUS-ENERGY STORAGE SYSTEM COSTS BENCHMARK iii-iv (2018).

3. *See* Peter Kelly-Detwiler, *Batteries About to Come to Texas in a Big Way*, TEX. RENEWABLE ENERGY INDUSTRIES ALLIANCE (Nov. 4, 2019), https://www.treia.org/news/2019/11/4/batteries-about-to-come-to-texas-in-a-big-way [https://perma.cc/MCS7-QW74].

4. Patricia Hutchins, *U.S. Utility-Scale Battery Storage Power Capacity to Grow Substantially by 2023*, U.S. ENERGY INFO. ADMIN. (July 10, 2019), https://www.eia.gov/todayinenergy/detail.php?id=40072 [https://perma.cc/8EDB-PJUN]. *See generally* LOLA INFANTE & OLGA CHISTYAKOVA, EDISON ELEC. INST., LEADING THE WAY: U.S. ELECTRIC COMPANY INVESTMENT AND INNOVATION IN ENERGY STORAGE (2018) (presenting case studies of a variety of battery storage projects developed in the United States).

5. Vikram Linga, *Most Utility-Scale Batteries in the United States are Made of Lithium Ion*, U.S. ENERGY INFO. ADMIN. (Oct. 30, 2019), https://www.eia.gov/todayinenergy/detail.php?id=41813 [https://perma.cc/Q2FL-9L2X].

since 2014 and the EIA projects this to continue climbing to over 2,500 MW nationally by 2023.[6] In 2019 alone, the grid-based energy storage market appears likely to have nearly double from the previous year.[7] There are several varieties of energy storage, from molten-salt thermal storage to batteries containing zinc or nickel, but lithium-ion batteries predominate in utility-scale deployment.[8] The United States Department of Energy ("DoE") attributes the popularity of lithium-ion batteries to their comparatively high storage capacity, small footprint, and ready availability.[9] Of the independent system operators ("ISO") and regional transmission organizations ("RTO"), PJM has the highest installed capacity for utility-scale batteries followed by CAISO.[10] For context, the largest battery storage systems currently operating in the United States are two forty MW systems in Alaska and California respectively.[11] However, the median project capacity for a utility-scale battery has been closer to ten MW[12] with an average duration of 1.7 MWh.[13] Significantly larger storage projects are now in the preliminary stages of development, with companies such as solar developer Intersect Power proposing to construct 495 MW of battery storage alongside a 495 MW solar installation in Borden County, Texas.[14]

Among the states, Texas has the third most operating utility-scale battery storage, with about half the installed capacity as

6. Hutchins, *supra* note 4.

7. Christian Roselund, *US Energy Storage Market Set to Almost Double this Year*, PV MAG. (May 22, 2019), https://www.pv-magazine.com/2019/05/22/us-energy-storage-market-set-to-almost-double-this-year/ [https://perma.cc/P8T7-Z4NT].

8. *Solar-Plus Storage 101*, OFF. OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Mar. 11, 2019), https://www.energy.gov/eere/solar/articles/solar-plus-storage-101 [https://perma.cc/S28Q-MFDD]. Aside from batteries and thermal energy storage, other types of energy storage include compressed air, flywheels, and, most significantly, pumped hydroelectric, which as of March 2018 accounts for more than 90% of energy storage capacity in the United States. *See About Electricity Storage*, EPA, https://www.epa.gov/energy/electricity-storage [https://perma.cc/97VQ-Z36Z] (last visited Dec. 16, 2019).

9. *Id.*

10. ALEXANDRA ZABLOCKI, ENVTL. AND ENERGY STUDY INST., FACT SHEET: ENERGY STORAGE FEBRUARY 2019 (2019).

11. Hutchins, *supra* note 4.

12. FU ET AL., *supra* note 2, at 6.

13. OFF. OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, *supra* note 8.

14. *See* Iulia Gheorghiu, *Developer Eyes World's Largest Solar+Storage Facility for Texas*, UTIL. DIVE (Feb. 19, 2019), https://www.utilitydive.com/news/developer-eyes-worlds-largest-solarstorage-facility-for-texas/548691/ [https://perma.cc/774W-G3W2].

California and slightly trailing Illinois.[15] In January 2019, the Electric Reliability Council of Texas ("ERCOT") reported that Texas's main power region has over eighty-nine MW of utility-scale battery resources installed, with an additional 2,300 MW of new battery capacity under study.[16] The *Houston Chronicle* subsequently reported that storage's generating capacity in Texas is expected to reach 360 MW in 2020 and that ERCOT has over 7,200 MW of large-scale battery storage in various stages of development for the next five years.[17] These battery resources are predominantly used to supply ancillary services,[18] although Texas is beginning to see battery systems installed for use in energy purchases and sale arbitrage in ERCOT's wholesale energy market.[19] In earlier stages of battery development, studies showed that benefit stacking, i.e. obtaining multiple value streams from a battery, including energy price arbitrage and capacity payments in addition to supplying ancillary services, was necessary to justify the high cost of investment in battery storage capacity.[20] Although benefit stacking is slowly becoming more commonplace, the declining costs of batteries and the availability of federal Investment Tax Credits ("ITC") for combined storage and solar projects are the primary causes of the recent dramatic increase in battery storage development.[21]

15. Hutchins, *supra* note 4.

16. *Growth of Energy Storage Resources in the ERCOT Region*, ERCOT (Jan. 2019), http://www.ercot.com/content/wcm/lists/164134/Storage_One_Pager_FINAL.pdf [**https://perma.cc/P85Y-LGZF**].

17. L.M. Sixel, *Battery Storage on the Verge of Changing Texas Power Grid*, HOUSTON CHRONICLE (Dec. 19, 2019).

18. *Id.*

19. For instance, Vistra Energy subsidiary Luminant will be using its new 42 MWh system at the Upton 2 solar facility in west Texas for energy arbitrage. *See e.g.,* Andy Colthorpe, *Tough Texas Market Conditions Defied as 42MWh Battery System Comes Online*, ENERGY STORAGE NEWS (Jan. 7, 2019), https://www.energy-storage.news/news/tough-texas-market-conditions-defied-as-42mwh-battery-system-comes-online [**https://perma.cc/RCV5-XTJN**].

20. *See e.g.* Judy Chang et al., *The Value of Distributed Electricity Storage in Texas: Proposed Policy for Enabling Grid-Integrated Storage Investments*, THE BRATTLE GROUP 1, 17 (Nov. 2014), https://brattlefiles.blob.core.windows.net/system/news/pdfs/000/000/749/original/the_value_of_distributed_electricity_storage_in_texas.pdf [**https://perma.cc/2LBC-R2G2**].

21. *Growth of Energy Storage Resources in the ERCOT Region*, ERCOT (Jan. 2019), http://www.ercot.com/content/wcm/lists/164134/Storage_One_Pager_FINAL.pdf [**https://perma.cc/P85Y-LGZF**]. *See generally* Stephen Comello & Stefan Reichelstein, *The Emergence of Cost Effective Battery Storage*, 10:2038 NATURE

The ITC is available to battery systems that are charged by a renewable energy resource at least 75% of the time and currently allows for a 26% tax deduction for projects starting construction in 2020.[22] However, this credit is being phased-down and is scheduled to decrease to 22% in 2021 and 10% from 2022 onwards for commercial systems.[23] The Environmental and Energy Study Institute ("EESI") notes that the price of lithium-ion batteries in electric vehicles, similar to the technology used in energy storage, has declined by 73% from 2010 to 2016 and has contributed to falling energy storage costs on the grid.[24] DoE estimates that the cost of a sixty MW storage system ranges from approximately $380 per kWh for systems that provide four hours of electricity to $895 per kWh for thirty-minute systems.[25] Projects that combine solar and storage are increasingly prominent, and costs of a storage system for such projects vary based on whether the photovoltaic and battery systems are at different sites or are co-located.[26] Furthermore, and by way of comparison, a solar-plus-storage project that offered a median energy price of $45 per MWh in 2017 is now competing with a similar solar-plus-storage project that came online in 2019 offering a median energy price of $36 per MWh.[27] Together, the declining costs of lithium-ion batteries and the availability of favorable tax policies appear primed to continue to accelerate utility-scale battery energy storage development in Texas.[28]

II. RECENT POLICY DEVELOPMENTS

COMMS., 1, 6 (2019), https://www.nature.com/articles/s41467-019-09988-z.pdf [**https://perma.cc/GH5P-2SWQ**].

22. Emma Elgqvist, Kate Anderson & Edward Settle*, Federal Tax Incentives for Energy Storage Systems*, NAT. RENEWABLE ENERGY LAB. (Jan. 2018), https://www.nrel.gov/docs/fy18osti/70384.pdf [**https://perma.cc/R549-YY3J**].

23. *See Business Energy Investment Tax Credit (ITC),* DSIREUSA.ORG (Mar. 1, 2018) https://programs.dsireusa.org/system/program/detail/658 [**https://perma.cc/EAG6-RFBR**].

24. ZABLOCKI, *supra* note 10, at 2..

25. OFF. OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, *supra* note 8.

26. *Id.*

27. Jason Deign, *Xcel Attracts 'Unprecedented' Low Prices for Solar and Wind Paired With Storage*, GREENTECHMEDIA.COM (Jan. 8, 2018), https://www.greentechmedia.com/articles/read/record-low-solar-plus-storage-price-in-xcel-solicitation [**https://perma.cc/922D-JC3D**].

28. *See generally e.g.,* Mark Watson, *Solar-Plus-Storage Likely the 'Next Big Thing' in ERCOT: Expert*, S&P GLOBAL (Oct. 22, 2018), https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/102218-solar-plus-storage-likely-the-next-big-thing-in-ercot-expert [**https://perma.cc/8GN7-7H6A**].

A significant driver of the increase in battery storage installations are changes to the regulatory environment, both nationally and at the state level, which are encouraging further development. At the national level, the Federal Energy Regulatory Commission ("FERC") issued Order No. 841 in February 2018 requiring ISOs and RTOs to revise their tariffs to remove barriers to entry in order for battery energy storage to better compete with other generation sources in wholesale energy, capacity, and ancillary services markets.[29] Key regulatory changes include ensuring that battery storage resources are eligible to provide all services that they are technically capable of offering and adjusting market rules to accommodate storage-specific attributes, such as bidding parameters that account for state-of-charge and allowing batteries to operate as both supply *and* demand resources.[30] In December 2018, the Energy Storage Association released its analysis of each ISO's and RTO's level of compliance with FERC Order No. 841.[31] It found that CAISO has largely implemented the market revisions required by the Order but that no other ISOs or RTOs had yet achieved full compliance and that further time for implementation would likely be necessary.[32] Texas's electric industry is regulated by the Public Utility Commission of Texas ("PUCT") largely independently of FERC. While FERC Order No. 841 generally does not apply in Texas, ERCOT and Texas market participants are monitoring such developments closely.[33] For instance, ERCOT has established the Battery Energy Storage Task Force to develop policy recommendations for consideration by the ERCOT Technical

29. *See generally Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, 162 F.E.R.C. ¶ 61,127 (2018).

30. Brian Orion & Sarah Kozal, *Five Key Takeaways from FERC's Recent Energy Storage Order*, POWER MAGAZINE (June 1, 2018) https://www.powermag.com/5-key-takeaways-from-fercs-recent-energy-storage-order/ [**https://perma.cc/5TJ5-TPGK**].

31. *Energy Storage Association Unveils Initial Assessment of Regional Grid Operator Compliance with Federal Regulatory Energy Commission's Order 841*, ENERGY STORAGE ASS'N (Dec. 11, 2018) https://energystorage.org/energy-storage-association-unveils-initial-assessment-of-regional-grid-operator-compliance-with-federal-energy-regulatory-commission-order-841/ [https://perma.cc/5XG6-HFAQ].

32. *Id.*

33. *Growth of Energy Storage Resources in the ERCOT Region*, ERCOT (Jan. 2019), http://www.ercot.com/content/wcm/lists/164134/Storage_One_Pager_FINAL.pdf [**https://perma.cc/P85Y-LGZF**].

Advisory Committee on operational and market design policies to better integrate battery storage resources into the market.[34]

In February 2018, the PUCT opened rulemaking proceeding Project No. 48023 to gather feedback from industry stakeholders to determine if regulatory changes are necessary to accommodate front-of-meter ("FTM") battery storage development and other non-traditional electric technologies.[35] This rulemaking was initiated following the dismissal of the transmission and distribution service provider ("TDSP") AEP's previous application in PUCT Docket No. 46368 to own and install a battery in a remote part of its service area in lieu of a more traditional distribution "wires" solution.[36] Pursuant to Public Utility Regulatory Act § 35.152, in Texas, battery storage is largely considered a generation resource.[37] Although batteries share characteristics with both generation and transmission/distribution, this legal designation as generation was implemented to maintain the distinction between types of market participants. In areas within ERCOT open to competition, transmission and distribution utilities are statutorily prohibited from owning generation resources.[38] In its application,[39] AEP noted that the specific wording of PURA § 35.152(a) states, "Electric energy storage equipment or facilities *that are intended* to be used to sell energy or ancillary services at wholesale are generation assets."[40] AEP argued that the battery at issue would not fall within Section 35.152(a)'s definition of generation because the battery would be used solely for reliability purposes as distribution equipment and not for the purchase or sale of energy or ancillary services.[41] However, other market participants raised concerns about

34. *See Battery Energy Storage Task Force*, ERCOT http://www.ercot.com/committee/bestf [https://perma.cc/8YL3-SS6A].

35. *Rulemaking to Address the Use of Non-Traditional Technologies in Electric Delivery Service,* Project No. 48023 (pending), PUB. UTIL. COMM'N TEX. (2018). Disclosure: the author represented Commission Staff in Project No. 48023 during his employment by the PUCT. No information beyond that which is publicly available is presented in this article.

36. *See generally Application of AEP Texas North Company for Regulatory Approvals Related to the Installation of Utility-scale Battery Facilities*, Docket No. 46368, PUB. UTIL. COMM'N TEX. (Feb. 15, 2018) (dismissing the proceeding and ordering that a rulemaking be opened to address the issues raised).

37. *See* PURA §§ 35.151–35.152 (2019).

38. *See* PURA §§ 31.002(6), 31.002(10), 39.105(a) (2019).

39. *Application of AEP Texas North Company for Regulatory Approvals Related to the Installation of Utility-scale Battery Facilities*, Docket No. 46368, Application at 4, PUB. UTIL. COMM'N TEX. (Sept. 16, 2016).

40. *Id.*

41. *Application of AEP Texas North Company for Regulatory Approvals Related*

the potential for distortion of market prices should ownership of batteries by transmission and distribution service providers become widespread.[42] Rather than make such a sweeping determination in the context of a contested case, the PUCT determined that the rulemaking process would better allow for consideration of the broad market implications involved and allow for greater stakeholder participation.[43]

In Project No. 48023, Commission Staff published thirteen Questions for Comment and received sixty-three comments and replies from a wide variety of industry stakeholders.[44] Comments addressed whether the Public Utility Regulatory Act allows an ERCOT TDSP to own a battery storage device, how energy inflows and outflows should be accounted for, potential battery ownership models, and regulatory approval processes in the event of TDSP ownership, such as an adapted certificate of convenience and necessity process.[45] In addition to AEP's grandfathered four MW Presidio battery,[46] Texas's largest utility, Oncor, noted that it operates five twenty-five kW batteries on its distribution grid in Dallas to study the effects of battery performance.[47] After meeting with stakeholders and reviewing these comments, the Commission announced at its Open Meeting on January 25, 2019, that it would put Project No. 48023 on hiatus during Texas's 86th Legislative Session.[48] Following the end

to the Installation of Utility-scale Battery Facilities, Docket No. 46368, Applicant AEP Texas' Initial Brief at 9–12, PUB. UTIL. COMM'N TEX. (July 7, 2017).

42. *See e.g. Application of AEP Texas North Company for Regulatory Approvals Related to the Installation of Utility-scale Battery Facilities*, Docket No. 46368, Joint Motion for Summary Decision of Luminant Energy Company LLC, TXU Energy Retail Company LLC, Alliance for Retail Markets, NRG Companies, Texas Energy Association for Marketers, Calpine Corporation, Texas Competitive Power Advocates, Texas Industrial Energy Consumers, and the Office of Public Utility Counsel, PUB. UTIL. COMM'N TEX. (Mar. 31, 2017) (disagreeing with AEP's positions and requesting that AEP's application be denied).

43. *See Application of AEP Texas North Company for Regulatory Approvals Related to the Installation of Utility-scale Battery Facilities*, Docket No. 46368, Order at 2–5, PUB. UTIL. COMM'N TEX. (Feb. 15, 2018).

44. *See Rulemaking to Address the Use of Non-Traditional Technologies in Electric Delivery Service,* Project No. 48023, Commission Staff's Memorandum, PUB. UTIL. COMM'N TEX. (Jan. 10, 2019) (summarizing comments).

45. *Id.*

46. *Rulemaking to Address the Use of Non-Traditional Technologies in Electric Delivery Service,* Project No. 48023, Initial Comments of AEP Texas and ETT at 14, PUB. UTIL. COMM'N TEX. (Nov. 2, 2018).

47. *Rulemaking to Address the Use of Non-Traditional Technologies in Electric Delivery Service,* Project No. 48023, Oncor Electric Delivery Company LLC's Response to Questions at 11–12, PUB. UTIL. COMM'N TEX. (Nov. 2, 2018).

48. *See Rulemaking to Address the Use of Non-Traditional Technologies in*

of the legislative session, the PUCT is anticipated to resume consideration of potential rulemaking changes in Project No. 48023.

During the legislative session, several statutory changes related to battery storage were proposed or adopted. For instance, Senate Bill No. 1012 amended PURA § 35.152 to clarify that electric cooperatives and municipally-owned utilities may own batteries without registering as power generation companies.[49] Perhaps the most intriguing was Senate Bill No. 1941,[50] which closely tracked the proposal from the comments filed by Texas Advanced Energy Business Alliance ("TAEBA") in Project No. 48023.[51] SB1941 would have permitted a TDSP to contract with a PGC, following approval by the PUCT, to receive energy from a battery for the purpose of ensuring reliable service to the TDSP's distribution customers.[52] The bill would not have allowed a TDSP to own the battery outright, but would permit the PUCT to authorize a contract for services if the TDSP's contract for use of the battery "is more cost-effective than construction or modification of traditional distribution facilities."[53] In order to incentivize TDSPs to make use of this potentially more cost-effective option, SB1941 would have allowed the TDSP to earn a "reasonable return" on such contracts.[54] The session expired before SB1941 could be adopted, but the near passage of this contract-for-battery-service model gives some indication of the Texas Legislature's direction on battery storage ownership and may influence the PUCT's direction if and when Project No. 48023 is resumed.[55]

Electric Delivery Service, Project No. 48023, Commission Staff's Memorandum, PUB. UTIL. COMM'N TEX. (Jan. 10, 2019) (summarizing comments).

49. TEX. S.B. 1012, 86th Leg., R.S. (2019) (adding Subsection (d) to PURA § 35.152); *see also* HJ Mai, *Texas Utilities Poised to Get Ability to Own Energy Storage Assets*, UTIL. DIVE (Aug. 13, 2019) https://www.utilitydive.com/news/texas-utilities-poised-to-get-new-ability-to-own-energy-storage-assets/560797/ [https://perma.cc/4DLR-LJKB].

50. TEX. S.B. 1941, 86th Leg., R.S. (2019).

51. *See generally Rulemaking to Address the Use of Non-Traditional Technologies in Electric Delivery Service,* Project No. 48023, Comments of Texas Advanced Energy Business Alliance, PUB. UTIL. COMM'N TEX. (Nov. 2, 2018).

52. TEX. S.B. 1941, 86th Leg., R.S. (2019).

53. *Id.*

54. *Id.*

55. *See* Suzanne Bertin, *In Texas, Incentives for Wind and Solar Development Were Extended, but Storage Questions Go Back to PUCT*, ADVANCED ENERGY ECON. (June 5, 2019) (discussing SB1941 and anticipated influence on Project No. 48023) https://blog.aee.net/in-texas-incentives-for-wind-solar-development-were-extended-but-storage-questions-go-back-to-puct [https://perma.cc/PEP6-KUXB].

III. CONCLUSION

While utility-scale battery storage development has increased steadily in Texas for the past several years, the coalescing of favorable statutory and regulatory changes alongside declining battery costs appear likely to supercharge batteries installed capacity in the Lone Star State. The hybrid nature of battery technology has raised questions that are unique to ERCOT about energy storage's place in the market, but as regulators and legislators develop policy about battery ownership models, further deployment will inevitably increase.