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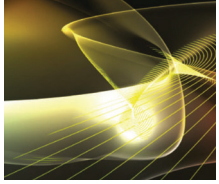

COMMENTARY

FERC Order 841 levels the playing field for energy storage

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ABSTRACT

FERC Order 841 focused on standardizing electric storage resource (ESR) participation in wholesale energy, ancillary services, and capacity market ruleset, by treating storage as a generation resource. Treatment of storage as a transmission asset (SATA) is up in the air. Expect to see FERC action on ISO/RTO compliance plans in 2019.

Energy storage is finally getting its due at the wholesale grid level, thanks to FERC Order 841. All the grid operators within FERC jurisdiction must comply with FERC order to allow "electric storage resource" to participate in their markets. Storage increases capacity value of renewables and decreases variability as the grid makes way for more renewables such as wind and solar. Market Monitors must understand that storage could "withhold" its capacity in early morning ramp hours for evening peak ramp hours, or participate in ancillary services regulation market without bidding into the energy market. At the same time, this resource could be a transmission asset, adding an additional level of complexity. This FERC Order 841 has its own challenges: (i) it treats storage as a generation asset, (ii) some (such as National Association for Utility Regulators) think FERC stepped on their toes, (iii) it does not address all the value stack benefits for storage-like transmission for example, and (iv) aggregation of distribution connected storage is side stepped. So the industry is watching for clear direction from their Federal regulator on this important technology, which is finally getting its due.

Keywords: energy storage; electrical properties; recycling

DISCUSSION POINT

- When will FERC decide on ISO/RTOs compliance filings for FERC Order 841? Will energy storage continue to pick up after FERC decision? Will transmission development companies embrace storage as a transmission asset? Will aggregation of electric vehicles bid into ISO/RTO markets? Will an Independent Market Monitor at an ISO/RTO penalize storage, for withholding their capacity?

Ellen Anderson's[1] article focuses on the conspicuous transformation of energy storage in the Midwest–a story no one else is telling. The Minnesota Energy Storage Alliance (MESA) convened two energy storage summits that were attended by audiences of more than 200 people, representing wide stakeholder segments, such as investor owned utilities (IOUs), independent power producers (IPPs), market participants, transmission owners, storage developers, Independent System Operators (ISO)/Regional Transmission Organization (RTO) and Public Utility Commission (PUC) staff, students, and industry leaders. A crowd of this size attending a conference in Minnesota is unheard of, unlike most energy storage conferences that are held either in San Francisco or San Diego. Her article addresses that unique MESA event.

Grid-scale energy storage is in the news for several reasons, including Federal Energy Regulatory Commission (FERC) Order 841[2]; California Energy Storage mandate Assembly Bill 2514[3]; Tesla's Elon Musk backing stationary storage in Australia[4]; the falling cost of levelized storage[5]; and the ability of energy storage to address capacity needs of system such as California's Aliso Canyon gas plant.[6]

FERC Order 841 focuses on standardizing electric storage resource (ESR) participation in wholesale energy and ancillary services and capacity market ruleset across the various ISO/RTOs within FERC jurisdiction, without which each ISO is ad hoc reacting to demands on its individual system needs. MISO, as the FERC regulated grid operator in the Midwest, filed a plan for compliance with FERC Order 841 on December 3, 2018, which includes implementation details for integrating ESRs in the MISO market starting 2020. Hence, Anderson's article is timely.

ISOs like MISO are seeing an uptick in generator interconnection queue requests related to energy storage, partly because energy storage at the same point of interconnection, such as solar, can reduce the variability of the energy resource.

MISO has approximately 500 MW of battery energy storage active as of February 15, 2019.[7] Both Pennsylvania's PJM[8] and New York's ISO have approximately 2000 MW in their individual queue,[9] whereas Southwest Power Pool[10] has twice that

amount at approximately 4300 MW in its generator interconnection queue. This is relevant because, at the same time it issued Order 841, FERC issued Order 845 directed to reforming generator interconnection process at ISOs. This order added ESR to the definition of "generation resource." The order also opened the possibility of surplus interconnection capacity for storage resources. This is important for the storage industry because new storage interconnection requests do not have to go through the entire study cycle, which takes a minimum of 18 months if they interconnect at, e.g., the point of an existing solar interconnection request.

FERC Order 841 treats storage as a generation resource. Storage as a transmission asset (SATA) is another value stack toward which ISO/RTOs are working. MISO is bifurcating SATA into two distinct buckets: reliability and economic projects. MISO is working with its stakeholders[11] to treat storage as a transmission alternative for reliability, with restrictions regarding when storage can discharge and when storage can participate in wholesale markets.

MISO is expected to file its SATA proposal with FERC in June 2019, seeking an order by September 2019–before the start of the 2020 planning cycle. The California ISO (CAISO) has suspended its SATA discussion with its stakeholders to address the gaps identified in its Energy Storage and Distributed Energy Resources (ESDER) Phase 4 proposals.[12] Former FERC Commissioner Jon Wellinghoff and his coauthors propose changes to CAISO's treatment of SATA and layout a path forward.[13] To date, FERC has not issued an order on SATA. Rather, the industry only has a policy statement from FERC Commissioner Cheryl LaFleur[14] for guidance.

FERC Chairman Neil Chatterjee, in his keynote address at Energy Storage Association (ESA) Policy Forum, noted that FERC is carefully reviewing the compliance plans submitted by each ISO/RTO in its December 2018 filings. He noted that some ISO/RTOs are working with their stakeholders on new products and services from ESRs and colocation of storage, with renewables being a key topic for FERC in the next five to ten years. Additional challenges to FERC Order 841 include ESR's ability to defer transmission investments because that Order treats storage as a generation resource, and concerns from the industry that FERC is overstepping its authority by including aggregation of distribution-connected ESRs.[15]

The energy storage industry sees FERC Order 841 as a long-overdue overhaul of the wholesale markets. However, ISO/RTOs are at different stages of storage development and needs on their individual systems. The ask of the industry is different in each of these wholesale markets administered by the grid operators. The Energy Storage Association (ESA) recommended that MISO allow ESRs to participate in providing multiple services. Energy-limited storage can be prevented from so participating if it is required to have an energy offer when providing ancillary services (A/S).

It is important for the storage industry that a clear framework on market mitigation exist at ISOs. The Independent Market Monitor (IMM) at MISO has commented on how it will treat capacity de-rates[16] for ESRs. The IMM has also stated that the IMM will consider the physical characteristics or contractual obligations of an energy storage resource that may not be offering to the market even when the resource is technically available. Finally, the IMM has stated that it is primarily concerned with assets that have actual market power.

ESA asked MISO for precise and explicit market mitigation criteria for storage not offering into markets so that market participants can effectively plan operations and business models. ESA also recommended that MISO indicates that storage located behind a retail meter capable of injection must be eligible to provide all wholesale services up to its full technical capability. ESA believes the intent of Order 841 is clear. Hence, ESA recommended MISO add language that states MISO will accommodate all forms of distribution-connected ESR in the FERC compliance proposal for the MISO market participation model, leaving the implementation details for addressing in 2019.

Additionally, ESA recommended that MISO recognize Order 841's 100-kW minimum market registration threshold in its compliance filing, and that MISO clarify that market participants may offer bid and registration parameter values in 0.1 MW increments.

Finally, regarding uninstructed deviations,[17] ESA understands from discussions with MISO that security constrained economic dispatch (SCED) is an instruction and not a dispatch. Resources that follow MISO commitment rules are, in general, held harmless. Asset owners (AO) can manage state of charge (SOC) self-scheduling, and, hence, decisions thereon are commercial. The SOC requirement will be set at the beginning of the operating day, and, in real time, is run every five minutes (termed unit dispatch solution) for the proceeding 10 min. However, MISO should provide AOs the ability to update the SOC within the operating day.

The industry is not satisfied with ISO compliance plans filed on December 3, 2018 with FERC intended to comply with Order 841. A key development from PJM is its 10-h capacity requirement for storage.[18] MISO currently has a four-hour capacity requirement to qualify as a capacity resource in its voluntary capacity auction (VCA). This 10-h capacity requirement is burdensome for some battery storage developers because they cannot sustain long-duration discharge cycles. However, flow-based battery manufacturers, such as Vionx,[19] and pumped-hydro storage providers can easily handle more than eight hours' storage capacity requirements. Capacity market prices are high in markets like that for PJM, with prices in the range of $140–$200 per MW-day.[20]

Flow-based batteries are promising because they use electrolytes that break down the components, requiring only two tanks–one to act as the anode and the other to act as the cathode. The electrons flow from the positive anode to the negative cathode when the battery is discharged, and when the battery is charging, the electrons reverse their flow. In an energy grid, a discharging battery is an energy "generator," and a charging battery is an energy "load." Vanadium redox flow and redox flow are the most common flow-based batteries because of longer and more life cycle, and more (greater than 100,000) cycles, compared to lithium-ion (10,000 cycles). Each battery charge and discharge is a cycle. A typical lithium-ion battery is expected to cycle once per day, and hence lasts 27 years (10,000/365).

However, it is expected that most grid-scale batteries cycle at least three times per weekday, equating to approximately 10 years of average life.

Flow-based batteries are longer in duration, an average of four to six hours, whereas lithium-ion batteries are mostly used for shorter duration, i.e., less than four hours. According to a Lazard's levelized cost of storage study, for an application on a distribution system, lithium-ion batteries cost around $261 per megawatt (1000 kilowatt) hour, equaling $0.26/kWh. Flow-based batteries cost anywhere from $0.20 to $0.30 cents per kWh. Advanced Research Projects Agency-Energy (ARPA-E) is looking to reduce the levelized cost of storage to $0.05 cents per kWh for longer duration (10–100 h).

Ancillary services are another area to which storage can provide services. CAISO Department of Market Monitoring (DMM) notes in its 2017 annual report on market issues and performance[21] that "*Average hourly provision of ancillary services from limited energy storage resources which includes batteries and other limited devices increased significantly during 2017, but remained low overall.*" The External Market Monitor for ISO-NE notes for New England markets that "*the lead time for developing solar resources is one to two years, while the development time for battery storage and demand response could be a few months.*"[22] These instances show the IMMs are adapting to new resources, such as energy storage, and their role in market surveillance and mitigation efforts.

In conclusion, FERC Order 841 focused on standardizing electric storage resource (ESR) participation in wholesale energy, ancillary services, and capacity market ruleset, by treating storage as a generation resource. Treatment of storage as a transmission asset (SATA) is up in the air. Compliance plans for ISO/RTO compliance are expected from FERC in 2019.

REFERENCES:

1. Anderson E.: Energy transformation and energy storage in the Midwest and Beyond. *MRS Energy & Sustainability* 6, (2019). Ellen Anderson chaired the Minnesota Energy Storage Alliance (MESA) of which I was a steering committee member, until MESA went from being housed at Energy Transitions Lab at University of Minnesota's Institute on the Environment (IonE) to Clean Grid Alliance (previously Wind On the Wires).
2. Federal Energy Regulatory Commission: *FERC Issues Final Rule on Electric Storage Participation in Regional Markets* (2018). Available at: https://www.ferc.gov/media/news-releases/2018/2018-1/02-15-18-E-1.asp#.XG0zxrh7lPY (accessed March 18, 2019).
3. California Public Utilities Commission: *Energy Storage* (2015). Available at: http://www.cpuc.ca.gov/general.aspx?id=3462 (accessed March 18, 2019).
4. Roberts D.: *Elon Musk bet that Tesla could build the world's biggest battery in 100 days. He won*. Vox Media (2017). Available at: https://www.vox.com/energy-and-environment/2017/11/28/16709036/elon-musk-biggest-battery-100-days (accessed March 18, 2019).
5. Lazard: *Lazard's Levelized Cost of Storage* (2018). Available at: https://www.lazard.com/media/450774/lazards-levelized-cost-of-storage-version-40-vfinal.pdf (accessed March 18, 2019).
6. Wagman D.: Energy storage rose from California crisis. *IEEE Spectrum* (2017). Available at: https://spectrum.ieee.org/energywise/energy/the-smarter-grid/california-crisis-tests-energy-storage-supply-chain (accessed March 18, 2019).
7. MISO: *Generator Interconnection Queue* (2019). Available at: https://www.misoenergy.org/planning/generator-interconnection/GI_Queue/ (accessed March 18, 2019).
8. PJM: *New Services Queue* (2019). Available at: https://www.pjm.com/planning/services-requests/interconnection-queues.aspx (accessed March 18, 2019).
9. NYISO: *Interconnection process* (2019). Available at: https://www.nyiso.com/interconnections (accessed March 18, 2019).
10. Southwest Power Pool, Inc.: *GI Active Requests* (2019). Available at: http://opsportal.spp.org/Studies/GIActive (accessed March 18, 2019).
11. MISO: *Electric Storage as a Transmission-Only Asset (SATOA)* (2019). Available at: https://cdn.misoenergy.org/20190213%20PAC%20Item%2003d%20Energy%20Storage%20as%20Transmission%20Reliability%20Asset%20(PAC003)317818.pdf (accessed March 18, 2019).
12. Meeusen K.: California ISO. *Storage as a Transmission Asset* [webinar] (2019). Available at: http://www.caiso.com/Documents/Presentation-Storage-TransmissionAsset-Jan142019.pdf (accessed March 18, 2019).
13. Cusick K., Wellinghoff J., and Kristov L.: *Storage as a Transmission Asset*: 2018 Progress and Report Card. Center for Renewables Integration (CRI) (2019). Available at: https://www.center4ri.org/publications/ (accessed March 18, 2019).
14. LaFleur C.A.: *Regarding Policy Statement on Cost Recovery by Electric Storage Resources*. Federal Energy Regulatory Commission (2017). Available at: https://www.ferc.gov/media/statements-speeches/lafleur/2017/01-19-17-lafleur-E-2.asp?csrt=8661101597322250338#.XGcDqbh7lPY (accessed March 18, 2019).
15. Federal Energy Regulatory Commission (2018). Available at: https://pubs.naruc.org/pub/AD1AE8A3-E37E-1E45-8DD4-2FB1351DB43E (accessed March 18, 2019).
16. The reduced qualified capacity within grid operator market.
17. These are deviations from grid operator given dispatch instructions.
18. Gheorghiu I.: *Tesla, others question storage hourly requirements, charges in FERC Order 841 compliance plans*. Utility Dive (2019). Available at: https://www.utilitydive.com/news/tesla-others-question-storage-hourly-requirements-charges-in-ferc-order-8/548315/ (accessed March 18, 2019).
19. Vionx Energy: *Unmatched Levelized Cost of Storage* (2018). https://www.vionxenergy.com/#cost (accessed March 18, 2019).
20. PJM: *2021/2022 RPM Base Residual Auction Results* (2018). Available at: https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx?la=en (accessed March 18, 2019).
21. Department of Market Monitoring-California ISO. *2017 Annual report on market issues & performance* (2017). Available at: http://www.caiso.com/Documents/2017AnnualReportonMarketIssuesandPerformance.pdf (accessed March 18, 2019).
22. Patton D.B., LeeVanSchaick P., and Chen J.: *2017 Assessment of the ISO New England Electricity Markets* (2018). Available at: https://www.iso-ne.com/static-assets/documents/2018/06/iso-ne-2017-som-report-6-15-2018_final.pdf (accessed March 18, 2019).