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Comparing Grid Operators' Energy Storage Market Proposals

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Issued early last year, the Federal Energy Regulatory Commission's Order No. 841 promised to change the regulatory landscape for energy storage participation in competitive electricity markets. The order amended FERC's regulations to remove barriers to the participation of electric storage resources in the capacity, energy and ancillary service markets operated by regional transmission organizations, or RTOs, and independent system operators, or ISOs.

To meet that objective, FERC directed the RTOs/ISOs to propose tariff revisions to meet Order No. 841's minimum requirements by Dec. 3, 2018, and to implement those revisions by Dec. 3, 2019. Those proposals were required to include, among other things, wholesale market designs with qualification criteria for energy storage resources at any interconnection level (transmission, distribution and behind-the-meter) to be dispatched in a way that recognizes their unique physical and operational characteristics.

Following lengthy stakeholder reviews over the course of the past year, the RTOs/ISOs submitted their proposed energy storage market participation models on Dec. 3. The compliance filings represent a spectrum of approaches, reflecting the fundamental differences among RTO/ISO market designs, and the extent to which some of those designs already met Order No. 841's minimum requirements before FERC issued the mandate.

We describe briefly each of the proposed RTO/ISO participation models below.

California Independent System Operator Corporation

CAISO is among the grid operators that has amassed considerable experience incorporating energy storage resources into its markets. In addition to various storage-specific programs, such as CAISO's multi-phase Energy Stoarge and Distributed Energy Resource initiative, CAISO had been implementing many of the minimum requirements of Order No. 841 before FERC's rulemaking was issued.

Under its existing tariff, CAISO implements technology-agnostic participation models that accommodate a variety of different energy storage resources at different interconnection levels. CAISO's main participation framework for traditional battery technologies is the non-generator resource, or NGR,

model, which allows resources to be dispatched as generation or load, and operate continuously across their entire capacity range.

Separately, CAISO implements a distinct participation model reserved for pumped-storage hydroelectric resources, and a demand response framework that is suitable for behind-the-meter and smaller-scale energy storage resources. CAISO also permits storage resources to aggregate into a single virtual resource, in order to meet minimum capacity requirements.

CAISO noted that it requested clarification or rehearing in the alternative on several issues that are still pending before the commission, such as metering and accounting practices to avoid double-billing resources that are subject to retail distribution charges. Those issues could be moot, however, if the commission were to accept CAISO's Order No. 841 compliance filing.

ISO New England Inc.

ISO-NE proposed a package of reforms that, along with a separate filing submitted in October of last year, differentiates between pumped-storage hydroelectric (the predominant storage technology in the ISO-NE region) and other electric storage technologies, with the introduction of the terms "binary storage facility" and "continuous storage facility."

The physical characteristics of binary storage facilities (i.e., pumped-storage hydroelectric facilities) allow them to be either on line to charge or on line to discharge, but not both simultaneously, whereas continuous storage facilities (e.g., batteries) can continuously transition between charging and discharging. To qualify as a binary storage facility, the resource must be capable of switching on within 30 minutes. To qualify as a continuous storage facility, a storage resource must be capable of switching between a charging state and a discharging state rapidly and continuously.

ISO-NE explained that "rapidly" means the ability to transition between the facility's maximum consumption capability and its maximum generation capability in 10 minutes or less, and "continuously" means the ability to be dispatched to any MW level in its negative to positive range.

Continuous storage facilities will be eligible to participate in ISO-NE markets as a generator asset type, which submits offers to supply energy; a dispatchable asset related demand asset type, which submits bids to consume energy; and an alternative technology regulation resource, which allows the resource to provide regulation services.

Midcontinent Independent System Operator Inc.

Before FERC issued Order No. 841, MISO was reforming its tariff to broaden energy storage resource participation in its markets. Those efforts stemmed in part from a complaint proceeding that prompted FERC to direct MISO to expand the rules for MISO's then-existing energy storage resource category. MISO's compliance filing builds on those efforts by proposing an energy storage resource category to address the minimum requirements of Order No. 841, as well as a specialized definition for market activities associated with energy storage resource charging and discharging.

MISO's proposed participation model facilitates energy storage participation in the energy and operating reserve markets, as both supply and demand, and will allow those resources to set market clearing prices, and provide energy and ancillary service products (or only ancillary services, if the resource prefers, through an exclusionary energy dispatch status). In addition to meeting MISO's

existing eligibility requirements for all market participants, MISO proposed to require energy storage resources to meet the applicable qualifications for each product and service that the resource is technically capable of providing.

In light of MISO's "diverse membership and state regulatory paradigms," distribution-sited energy storage resources will need to execute a newly-proposed pro forma that addresses the requirements, rules and concerns specific to the distribution system.

New York Independent System Operator Inc.

NYISO's proposed reforms are partially the product of a stakeholder process evaluating energy storage market participation that began in 2016. Prior to Order No. 841, NYISO permitted energy storage resources to participate in some of its markets through various means, such as the limited energy storage resource model, which allows short-duration facilities (i.e., those unable to sustain operations at maximum injection/withdrawal for at least an hour) to provide regulation services, and NYISO's demand response programs.

In its compliance filing, NYISO proposed a new framework for participation in the day-ahead and real-time markets tailored specifically to energy storage resources that are capable of injecting energy on to the grid for longer durations than limited energy storage resources. NYISO's proposal contemplates that energy storage resources participating under the new model will be dispatch-only. Put another way, those resources will bid energy across their entire operating ranges, and will be treated by NYISO as always "on" and available for dispatch, with no need for a start-up period.

This is markedly different than other categories of NYISO market resources that can also bid commitment parameters (e.g., minimum run time), in addition to dispatch parameters, and reflects, in part, NYISO's push to accommodate newer and more advanced storage technologies that are currently being contemplated for deployment within New York.

PJM Interconnection LLC

In a pair of filings, PJM proposed a new energy storage participation model, and proposed to broaden the resource category definitions applicable to energy storage resources. PJM explained that its existing resource categories applicable to storage fall short of Order No. 841's requirements.

In particular, PJM's existing energy storage resource category is limited to those resources that inject solely on to the wholesale grid, while PJM's existing capacity storage resource is limited to a hydroelectric power plant or flywheel or battery storage technologies used solely for storage and short-term injection to the grid. PJM proposed to broaden those definitions, by permitting such resources to also provide retail service and participate in the reliability pricing model, which is PJM's three-year forward capacity market.

In addition, although PJM's capacity, energy and ancillary services markets offer a number of market opportunities for participating resources, PJM's new ESR participation model will explicitly address each available product to ensure that energy storage resources are eligible to provide all services they are technically capable of providing. For example, the proposed ESR participation model emphasizes an energy storage resource's capability to respond to real-time dispatch and price setting, which are characteristics more suited to smaller resources that can alternate between charging and discharging states. PJM's proposal also facilitates energy storage resource participation in the RPM.

Southwest Power Pool Inc.

SPP proposed to introduce multiple avenues for energy storage resource participation in SPP's integrated marketplace. Under newly-proposed definitions, energy storage resources will participate as an existing resource type or under the new market storage resource, or MSR, participation model that is exclusive to energy storage resources.

SPP explained that the MSR registration option will allow SPP to dispatch the MSR to withdraw energy from the market, include the physical and operational characteristics of MSRs in the market dispatch, and clarify that transmission charges will not apply for MSR withdrawals when those withdrawals are a result of the MSR responding to an SPP dispatch. Unlike other types of resource categories, MSRs will also be able to submit financial and operational offers to both inject and withdraw in the day-ahead market and real-time balancing market.

SPP also noted that, while it does not have a capacity market, there is a resource adequacy requirement applicable to load serving entities that could potentially be satisfied through the designation of an energy storage resource.

Conclusion and Next Steps

FERC's Order No. 841 rulemaking represents the convergence of changing energy policies that must increasingly reflect the impact of newer technologies, such as batteries and distributed resources, and the agency's statutory obligation to ensure just and reasonable rates. In that regard, Order No. 841, at its core, is about leveling the playing field for electric storage resources and enhancing competition in the wholesale markets that fall under FERC's regulatory purview.

To be sure, the compliance filings represent a significant step toward that goal. They are also, in some respects, aspirational starting points. Several of the RTOs/ISOs still have significant work left to do before they can implement their proposed participation models, including complex software changes, operator training and updated procedures. Recognizing those challenges, several of the RTOs/ISOs requested prompt commission approval for their proposals, in order to accommodate necessary testing before the Dec. 3, 2019, implementation deadline.

Meanwhile, FERC is still gathering comments on the RTO/ISO proposals and, separately, is mulling requests for clarification and rehearing of Order No. 841 on key issues, such as the boundaries of federal and state jurisdiction, and opt-outs for states that would prevent distribution-level storage resources from participating in wholesale markets. Market participants in any given RTO/ISO with an interest in energy storage are advised to stay tuned for the commission's response on the RTO/ISO compliance filings, as well as the pending requests for clarification and rehearing.

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