FERC Order 841: Electric Storage Participation in Wholesale Power Markets

Requires wholesale electric power markets to create new rules that will allow for the participation of energy storage resources.

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WHAT IT DOES

Federal Energy Regulatory Commission (FERC) Order 841 opens wholesale electric markets to energy storage resources in regional electricity markets. According to this final rule, by November 12, 2018, the seven Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) in the US must propose updates to their pricing schemes and develop new strategies to incorporate energy storage resources in those markets.

This rule covers all storage technologies interconnected to the transmission system, distribution system, or behind-the-meter. Storage resources that are currently participating in demand-response programs can continue doing so under the new rule.

This rule mandates that:

- Storage participating in wholesale markets should be able to recover costs through both cost-based and market-based rates.
- Storage should be allowed to provide all capacity, energy, and ancillary services according to its technical capability. This requirement recognizes the rich service potential of storage, including the ability to provide services that certain ISO/RTOs do not procure from organized market mechanisms, e.g., blackstart services, frequency regulation, and reactive power services. In the event that ISO/RTOs provide compensation for these services outside of market mechanisms, storage should be eligible for that compensation.
- The proposed bidding parameters should consider the physical and operational characteristics of different storage technologies.
- The general pricing rules for storage should be the same as energy resources. Storage would participate in the market both as wholesale buyers and wholesale sellers, and should be able to set the wholesale market clearing price. The buying and selling prices of energy storage should be the locational marginal price, or the price specific to a given location.
- The minimum size requirement to participate in the wholesale market must not exceed 100 kW.

This rule has the potential to significantly expand the existing market for storage resources and develop more services that storage technology is capable of providing. Previously, only a few storage projects have been proposed to replace fossil fuel or nuclear generation capacity.

The majority of storage capacity is currently located within the fast-responding frequency regulation markets. Geographically, the wholesale markets covering 13 eastern states (PJM Interconnection) and California (CAISO) are the two largest energy storage markets in the US, which make up 81% of the aggregate deployment in storage. This is largely due to the increasing renewable integration in PJM’s and CAISO’s energy mix. Since the real-time energy output from renewable resources cannot be predicted accurately, and the availability of the resources are time-varying, the demand for fast-responding frequency regulation increases accordingly in these two markets.

BACKGROUND
Energy storage technologies have been in use for nearly a century. While pumped-hydro and compressed air energy storage are the most mature energy storage technologies, the current landscape of storage is mostly driven by battery technologies. The main purposes of grid-connected battery projects in the US before 2009 were either new technology demonstration or using established technologies to solve unusual problems. The American Recovery and Reinvestment Act of 2009 (ARRA) opened up large number of financing opportunities. Since 2010, the energy storage market size has started to grow significantly faster and more diverse compared to the previous decade.

The production costs of commercially-deployed energy storage technologies continue to decrease, which have increased their feasibility. In general, storage is becoming a faster and more flexible approach to manage transmission and distribution needs. In particular, flexibility brings cost-effectiveness when actual load growth is less than the anticipated growth. In some niche cases, for example, in small remote grid-connected or off-grid regions, storage has also become an economical choice.

Energy storage, especially battery options, have become more integrated into the grid resilience portfolio after several recent superstorms and hurricanes. The major uses of battery energy storage have so far been grid resilience, military energy assurance, and deployment in case of emergency, which typically does not generate revenue. Market analyst consider the creation of multiple value streams as crucial to the development of storage systems as sustainable business ventures.

Several ISO/RTOs have already established certain rules of participation for energy storage. For example, PJM has been operating several battery and flywheel storage projects since 2011. CAISO started the implementation of its Energy Storage and Distributed Energy Resources (ESDER) project in 2016 to lower the market entrance barriers for storage and distribution-connected resources.

RELEVANT SCIENCE

The US Grid

The electricity supply chain consists of three main parts: generation, transmission, and distribution. Unlike many other countries that have largely vertical structures, the power market restructuring in the 1990s and 2000s has created a landscape of competitive markets but also preserved some of the regulated markets in the US. In a regulated market, vertically-integrated utilities own generation, transmission and distribution systems; in deregulated competitive markets, these three parts are run separately. Currently, the majority of US electricity load is in the competitive markets.

Balancing authorities (BAs) in competitive markets dispatch electricity to meet electric demands in real time within a certain area. ISOs and RTOs are two kinds of BAs that operate within FERC’s jurisdiction. ISOs and RTOs make decisions independent from other market participants under a principle meant to ensure non-discriminatory access to the electric grid. Currently, there are seven ISO/RTOs operating in the US.

Grid Reliability Services

The majority of the grid in the US transports alternating current (AC) power; the system frequency in the US is set at 60 Hz, which means that the current changes directions 60 cycles per second. An AC grid requires a variety of reliability services due to its physical characteristics. Because the balance of electricity demand and supply is constantly changing, essential reliability services are needed to maintain steady power transmission and avoid damage to generators and equipment. These services, including frequency regulation, reactive power compensation, and ramping and balancing services, are also frequently referred to as ancillary services.

Energy storage facilities can contribute to frequency regulation much quicker than conventional generators, generally within 30 seconds of detecting fluctuations in load. Energy storage systems can also provide these services more efficiently than traditional power generators, which have slower ramp rates and may need to increase or decrease their generation output significantly in order to balance out the grid.
Potential Value Streams for Storage

To make energy storage profitable, FERC believes that it is essential for storage technologies to participate in the wholesale energy market on an equal basis as conventional generator, such as natural gas and coal power plants, that currently provide energy and ancillary services. This may mean being allowed to charge prices for a variety of grid services. For instance, batteries and other storage systems can be charged during a low-price period and discharged when prices go up and peak, which can reduce the system cost of electricity. This process is known as energy arbitrage.

CONTROVERSIES & IMPLICATIONS

Payment allocations and federal-state coordination

Some experts, including FERC Commissioner Cheryl LaFleur, anticipate that coordinating between different jurisdictions and interconnection levels will be a major challenge for energy storage participation in the grid. While interstate transmission is under Federal regulation, the distribution system is under the state’s. However, the multiple application of energy storage enables it to participate on different grid levels. Market manipulation and unclear pricing schemes are the two concerns raised by this new FERC rule. The Transmission Access Policy Study Group (TAPS) has proposed that distributed-connected storage resources should be required to bid exclusively in one market, either wholesale or retail. TAPS is concerned that market manipulation can occur if a distributed storage service purchases energy from one market and then discharges it in another market. This is due to the difficulty in verifying the source of any particular amount of energy discharging to the grid. LaFleur also notes the importance of “who pays what to whom for what,” or how to coordinate between federal and state policies, as one of the main issues for FERC to tackle next.

Management of small-scale energy storage

Before the FERC Order, several ISO/RTOs had implemented rules for energy storage to participate in the markets, but only for a limited number of energy or ancillary services and as a new category of resources separate from generation. Further, the minimum capacity requirements varied from 100 kW to 5 MW. FERC’s order mandates that the minimum capacity requirement for storage to participate in wholesale markets should be no higher than 100 kW. Grid operators have expressed concerns that the amount of small energy storage operators allowed in the wholesale market annually should be capped to control the influx encouraged by this small threshold. They allege that energy storage resources of 100 kW in capacity are difficult to manage due to their small size and limitations to current software. Midcontinent Independent System Operator (MISO) has commented that this new threshold would require extensive software reprogramming.

ENDORSEMENTS & OPPOSITION

Endorsements:

- Tom Werner, CEO of SunPower Corp., a solar company: “Solar [power] plus storage is getting near the point where it can compete with natural gas peakers...what the FERC ruling allows is the most economical solution to be able to bid in and compete.”
- Michael Panfil, Director of Federal Energy Policy and Senior Attorney at the Environmental Defense Fund: “Giving energy storage the same opportunity to compete in the marketplace as other resources like gas and coal will help make electricity more affordable, clean, and reliable for Americans. Distributed energy like rooftop solar and microgrids can provide similar benefits, and FERC should quickly and concretely take steps to provide access for these resources.”

Opposition:

- The National Association of Regulatory Utility Commissioners: “The Final Rule fails to recognize explicitly this aspect of state jurisdiction over storage resources located on the distribution system. State Commissions are actively pursuing deployment and
use of State-jurisdictional storage resources. To avoid inhibiting ongoing State storage deployment initiatives, FERC should immediately grant rehearing to clarify that the States retain authority to determine whether resources located behind a meter or on the distribution system are allowed to participate in the wholesale markets.”

- Utility groups American Municipal Power, Inc., the American Public Power Association, and the National Rural Electric Cooperative Association: “The Final Rule suggests that [electric storage resources] located on a distribution system or behind a retail meter may circumvent restrictions under state or local law on retail customers directly purchasing from, or selling into, the wholesale market - actions that are beyond the Commission’s jurisdiction to authorize.”

**STATUS**

The rule is final and will go into effect on June 4, 2018.

**RELATED POLICIES**

- **H.R.4649** - Energy Storage Tax Incentive and Deployment Act of 2017: This bill was introduced in the House on December 14, 2017. Originally sponsored by Rep. Michael F. Doyle (D-PA-14) and Rep. Peter Welch [D-VT-AL], it intends to amend the Internal Revenue Code to allow tax credits for energy storage technologies.

- **S.1455** - Energy Storage Goals and Demonstration Projects Act: This bill was introduced in the Senate on June 28, 2017. Originally sponsored by Sen. Martin Heinrich (D-NM), it intends to amend the United States Energy Storage Competitiveness Act of 2007 and propose the DOE to establish new goals as well as demonstration program concerning energy storage.

- **S.1876** - Reducing the Cost of Energy Storage Act of 2017: This bill was introduced in the Senate on September 27, 2017. Originally sponsored by Sen. Sheldon Whitehouse (D-RI) and Sen. Jack Reed (D-RI), it intends to establish a program to advance energy storage deployment to reduce various costs of energy storage.

 Proposed revisions to the [Pro Forma Large Generator Interconnection Agreement](https://www.ferc.gov/industries-markets/electric/interconnections-transmission-issues/omsc/docs/pro-forma-large-generator-interconnection-agreement.pdf): This is another proposed rule-making during the same period that asks ISO/RTOs to clarify requirements for energy storage providing primary frequency response services.

State policies: California (target of 1325 MW of utility-scale storage by 2020), Nevada (call for investigation on energy storage target), Washington (call for investor-owned utilities to incorporate storage), New Hampshire (inclusion of energy storage in distributed energy resources for electricity transmission and distribution), New York (governor proposed target of 1500 MW by 2030), Massachusetts (target of 200 MWh by 2020), and Oregon (target of 5 MW per utility by 2020) have active energy storage policies behind-the-meter, in-front-of-the-meter, or both.

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**ENERGY SUBCATEGORY**

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