



September 12, 2018

The Honorable Fred Upton
Chairman Subcommittee on Energy
U.S. House of Representatives Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515-6115

Dear Chairman Upton,

Thank you for the opportunity to testify before your committee on July 18, 2018, at the hearing entitled, "Powering America, The Role of Energy Storage in the Nation's Electricity System." Enclosed are my responses to the questions for the record that were provided to me on August 29, 2018. Please do not hesitate to contact me if I may be of further assistance.

Sincerely,



Mark A. Frigo
Vice President, Head of Energy Storage, North America
E.ON



The Honorable Greg Walden

1. *FERC issued Order No. 841 earlier this year, and asked the RTOs/ISOs to ensure their market rules are not creating barriers to the participation of energy storage resources in their capacity, energy, and ancillary services markets. As these market operators are contemplating their responses.*
 - a. *For your perspective, are the markets working? Are energy storage resources able to compete? If not, what are the barriers?*

The markets are not currently working in a way that completely unleashes the full benefits that energy storage can provide. FERC Order 841 was a great start, with its goal to remove barriers to storage. RTOs/ISOs are still in the beginning stages of implementing the Order, so it is too early to tell the success of that Order. However, a number of stakeholders have lodged rehearing requests at FERC for the Order. These rehearings would only delay the necessary implementation of the Order, and as such, remain a barrier within the organized markets. It would be best for FERC to deny these requests for rehearings to allow the RTOs/ISOs to implement the Order without delay. Also, FERC Order 841 only targets the organized markets, which according to EIA, covers approximately 60% of the U.S. electric power supply. For those areas not in organized markets, the Order does not clarify how the ratepayers and electricity systems will realize the full benefits of energy storage.

The Honorable Fred Upton

1. *According to EIA, about 90% of large-scale battery storage capacity in the United States is installed in the regions covered by five of the seven organized markets (RTOs/ISOs). Nearly 40% of existing large-scale battery storage power capacity lies in the PJM footprint, the next being CAISO with 18% existing power capacity.*
 - a. *What circumstances led to the PJM market having this large share of large-scale battery storage capacity.*

The PJM RTO recognized the technological benefits of energy storage and its capability to respond to grid problems quicker than traditional resources. As such, PJM in 2012 split their frequency regulation service into two markets: “Reg A” which includes traditional generators with slower ramp rates, and a new fast response frequency regulation market called “Reg D” which have very fast ramp rates. The formation of this Reg D market was the first to recognize the fast ramp



rates of energy storage and allowed for a quick proliferation of energy storage. We are seeing the beginning of fast responding frequency regulation markets in other parts of the country, but other RTOs have not been as aggressive in implementing these types of markets.

b. Could market rules in PJM be utilized in other competitive electricity markets?

Yes, however, PJM has recently introduced rule changes governing the Reg D market that are at odds with its original design. These rule changes included a cap on the amount of Reg D resources that could be procured, a negative change in the “benefits factor” calculation that determines revenue for Reg D resources, and a change in the signal from 15 to 30-minute dispatches (most PJM energy storage assets were designed for 15 minutes). These changes have subsequently hurt energy storage and thus should not be carried forward to other markets.

2. In your testimony, you mention that market rules for competitive electricity markets should not only ensure the participation of energy storage resources but should be examined to ensure that interconnection process do not constitute barriers to entry.

a. Can you explain in further detail how interconnection processes could be a barrier to entry or impede energy storage resources ability to compete?

Unlike other projects, energy storage can be designed, built, and brought online relatively quickly, usually in a matter of months. Interconnection processes, which stretch on for years, significantly slows deployment of storage resources on the grid, and adds burdensome costs and delays ratepayer savings. In some organized markets, interconnection processes which should only take up to two years to complete are actually taking up to six years. This has a significant negative impact to all projects, but especially for energy storage projects. In addition to the time burdens, differences in the process and analysis between interconnected markets creates unsynchronized analysis between the two markets. While provisions exist to interconnect under provisional terms, it is not prudent as a business to take the step of investing millions of dollars of capital expenditures in the face of uncertain risks which hinge on completion of a study.

One specific opportunity that has provided benefit in CAISO and has capability under certain provisions elsewhere is allowing for peak-shaving projects (one of the many application of energy storage). This was mentioned in my and others’ testimony. This concept is the co-location of large-scale storage with other generation without increasing net output to the grid. This allows grid operators to shift generation to when it is needed most, while at the same time avoiding



unnecessary and costly upgrades. Further expansion of this concept with defined rules across all markets would help lower barriers.

Reliability of the grid, which is nominally the purpose of interconnection studies, is of the utmost importance, but eliminating unnecessary barriers and inefficient processes – particularly between connected markets – to better allow projects to participate on the grid would help spur the deployment of energy storage.

The Honorable Jerry McNerney

1. How would each of you properly value storage?

Energy storage can provide multiple services to the grid, depending upon when and how it is used. The business case for energy storage projects is dependent upon revenue from these multiple sources. This is referred to in the energy industry as the “revenue stack.” As such, the value for energy storage is a function of the revenue that is received from these multiple services netted from the costs associated with the operational parameters of the energy storage system. To properly value storage from a compensation perspective, grid operators need to allow for the full revenue stack to be considered for storage projects. Many markets still do not recognize the full value stack of this uniquely flexible technology, resulting in barriers to market participation.

2. Can you provide examples of how market rules remain a barrier to energy storage? What can be done about each of these barriers?

The markets are not currently working in a way that completely unleashes the full benefits that energy storage can provide. FERC Order 841 is a great start, with its goal to remove barriers to the participation of energy storage. RTOs/ISOs are still in the beginning stages of implementing the Order, so it is too early to tell the success of that Order. However, a number of stakeholders have lodged rehearing requests at FERC for the Order. These rehearings would only delay the necessary implementation of the Order, and as such, remain a barrier within the organized markets. It would be best for FERC to deny these requests for rehearings to allow the RTOs/ISOs to implement the Order without delay.

A couple of examples of barriers include 1) no proper, or wrong, classification of energy storage within the current regulatory framework, and 2) lack of tariff clarity on charging. These examples are prevalent in several markets across the U.S. The current regulatory framework across the country classifies energy assets into one of three general buckets, generation, transmission/distribution, and load (i.e. demand). Because of its unique



flexibility, energy storage does not neatly fit into one bucket. It is both generation (discharging) and load (charging). Depending upon its application, or use, it can be a generation or transmission/distribution asset. Until market rules are clear regarding energy storage, and how utilities can properly recoup their cost from ratepayers, utilities will hesitate to use it widely, or delay its implementation. In addition, there is confusion on what tariff structure energy storage should use for charging, as there are no clear tariff structures for energy storage charging. For example, in some places, energy storage projects are billed at higher retail rates for charging, but compensated at lower wholesale rates when they discharge that same energy back to the grid. In other places, energy storage projects pay a demand charge – essentially a markup based on retail energy consumption – but are actually used for generation. These inconsistencies increase uncertainty and remain a barrier to further penetration of energy storage.