RECENT U.S. POLICY AND LEGAL IMPLICATIONS FOR ENERGY STORAGE VIS-À-VIS RPS MANDATES

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ABSTRACT

The fast-approaching implementation dates for United States Renewable Portfolio Standards (RPS) accelerate the need for a clear energy storage federal policy. Further, the evolution from a vertical electricity delivery system to a market-based design structure and the technical challenges to transform the existing system to the next-generation smart grid require large-scale energy storage installations. However, energy storage at the utility level has a multiple personality. For, depending on its application, commercial, megawatt-scale energy storage devices can provide generation support, transmission and distribution asset deferral, or supply ancillary services as a market function. Each of these roles for energy storage brings with it legal and policy questions.

Keywords/phrases: RPS, grid-connected, energy storage, policy, market design

INTRODUCTION

In the United States, 29 states and the District of Columbia have adopted a Renewable Portfolio Standard, or RPS. A typical RPS requires an increase in renewable energy resources that involve wind, solar, and geothermal technologies. Just as the type energy of source may vary, so do the full implementation dates. The RPS is at the state level; thus there are several layers of complexity:

(1) There is not a U.S. federal policy for RPS;
(2) The regulations for RPS (about 40% of U.S. electricity sales) vary from state to state or are non-existent;
(3) Importing Variable Energy Resources (VERs) into the grid affects reliability;
(4) Energy storage was not specifically written into the legislation for RPS; and
(5) There are environmental and market policies that affect the use of electrical energy storage at the federal, state, and local levels.

BACKGROUND

The U.S. Federal Energy Regulatory Commission (FERC) is responsible for regulating interstate transmission of electricity, natural gas, and oil. As part of its duty to the consumer, the FERC provides standards to protect the reliability of high-voltage interstate transmission and monitors energy markets.

As recently as February 2011, FERC issued a Notice of Proposed Rulemaking that would require each of the grid operators under its jurisdiction to structure their regulation market tariffs to provide pay-for-performance (PFP). Grid operators would require implementing a pricing structure that pays faster ramping resources a higher price for their service. This, of course, implies use of energy storage technologies like the flywheel.

If adopted, then the PFP becomes a FERC market policy that will reward specific storage technology. The issue is that yet other policy positions have to be adopted for VERs, energy efficiency goals, and RPSs to be effective. The issue is that the energy storage industry perhaps has not clearly communicated the following:

- Energy storage is NOT a product.
- Liability issues specific to certain energy storage technologies hamper implementation (i.e., Compressed Air Energy Storage [CAES]).
- Energy storage is an enabling technology that has legal implications for adding renewable resources to both transmission and distribution systems.

PROBLEM

Electric power dispatchers manage variable, intermittent renewable energy sources by maintaining sufficient spinning reserves, adding automatic generation in fast-responding combustion turbines, or upgrading ramping rates. These technology applications represent temporary patchwork solutions. Deeper electric grid penetration of renewable resources will require energy storage for rapid dispatch and reliability. There are ten (10) pumped storage plants and a single CAES facility in the United States, and only one state that has written legislation to satisfy RPS targets [California AB2514] [1]. Even without RPS mandates, the many roles that advanced energy storage applications and technologies can play require an update of energy policy.

DISCUSSION

The Energy Storage Council (ESC) defines five distinct elements of the electric power market: fuel or energy sources, generation, transmission and marketing, distribution support, and energy services [2]. Energy storage can easily be an integrator of the existing market segments for conventional and renewable resources to create a more responsive market, and energy storage can also aid in technical challenges.

Energy Storage as Generation Support

Harvesting storage of bulk energy during low demand (at night) then using the commodity in the daytime can satisfy peak demand on any given system. This approach permits arbitrage of both the production price of both demand periods as well as a uniform load factor for generation (and possibly also transmission and distribution [T&D] systems). Further, when coupled with VERS, energy storage can represent baseload generation support; thus it has a dual role as generator and purchaser in an RPS arrangement.

Storage as Transmission and Marketing

Conditions on the power grid constantly change as loads change or as disruptions occur across the network (for wholesale power). Utilities ramp power plants up or down second by second to follow the load. Timing and access for loads help to account for congestion on the transmission system, which may require an expense to utilities that have to use stabilizing equipment. Requirements associated with the smart grid and use of renewable resources introduces even more stability issues. Energy storage is a viable resource for generation and transmission facilities for increased demand as well as for asset upgrade deferral.

The American Electric Power (AEP) company wanted to add a battery storage system into its system upgrade in Texas that has huge wind resources. AEP requested that the energy storage device be treated as a transmission facility (and therefore eligible for cost recovery through regulated transmission rates) and not as an energy market participant [3]. The Public Utility Commission (PUC) of Texas permitted AEP's battery as a transmission facility, with FERC's blessing. Western Grid Development got FERC's approval for a similar request but under protest from CAISO [4], who would have to include the project as part of its Independent System Operator (ISO) regional planning process.

Storage and Ancillary Services

Regulation power consists of short spikes of power supplied when the grid is destabilized due to sudden increases in demand. Batteries are ideal to provide a stabilizing function, with small amounts of power. PJM uses lithium-ion batteries for regulation power. As early as 2009, the PJM interconnect operators demonstrated that transmission networks should be permitted to employ batteries to improve grid stability and reliability by balancing variations in their load.

A utility can become caught up in the current policy requirement that compels third-party sellers of ancillary services to prove in a formal study that they lack market power before being permitted to sell their services at market-based rates [5]. Other ancillary services that storage can support include asset deferral, contingency service, black start, voltage regulation, and area control. Here the term area control is defined as the prevention of unplanned transfer of power between one utility area and another.

SUMMARY

Energy storage can play several roles in the vertical electricity delivery system: generation support, transmission, or bulk distribution at the utility level. As a market function, storage can be part of a system's energy management, bridging power, or as an ancillary service providing operator's tools to ensure power quality, reliability, or stability. The challenges of grid integration of renewable energy sources from the U.S. RPS mandates have brought to light a need to address legislative, regulatory, economic, and technical requirements related to energy storage.

Policy is the tool to advance technical challenges like integration of renewable energy sources into the existing grid. Energy storage is the catalyst to drive business models for electric power market strategies. But it is the group of subject matter experts who serve as resources to connect the dots for the end user and stakeholder to understand the many applications of energy storage for the next-generation (smarter) grid.

RECOMMENDATIONS

Energy storage experts, system operators, utility managers, and other stakeholders can work together to develop policy positions and propose industry standards that define the boundaries of energy storage – in particular regulated functionality versus a market functionality.

CONCLUSIONS

Whether the energy sources are conventional or renewable, federal regulators and state utility asset owners must take a position to improve current policy to complement emerging energy storage technologies and applications to help move market design forward.

REFERENCES

[1] California Legislature – 2009-10 Assembly Bill Number 2514, "An Act to Amend Section 25302 of the Public Resources Code, and to Amend Sections 454.3. 9615, and 9620 of, and add Chapter 7.7 to Part 2 of Division 1 of, the Public Utilities Code, Relating to Energy (Storage)," Proposed by Nancy Skinner, approved by the California Legislature on June 21, 2010, and signed into law by Governor Arnold Schwarzenegger on September 29, 2010.

AB 2514 will mandate storage equal to 2.25% of daytime peak power by 2014 and 5% of daytime peak power by 2020. The bill would additionally require each electrical corporation and local publicly owned electric utility, commencing January 1, 2011, to implement a 5-year program to employ distributed thermal, mechanical, or electrochemical energy storage systems to maximize shifting of electricity use for air-conditioning and refrigeration from peak demand periods to offpeak periods. The bill would require each electrical corporation and local publicly owned electric utility to develop energy storage plans to meet the energy storage portfolio procurement requirements and to report certain information to the Energy Commission.

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BIOGRAPHICAL NOTE

Jacquelynne Hernandez, Member of Technical Staff at Sandia National Laboratories (SNL), is in the Energy Systems Analysis group.

Education: BSEET (focus area: Power Electronics) from DeVry Institute of Technology in Decatur, Georgia; BSEE – University of New Mexico, MSEE – New Mexico State University – Power Engineering, part of the Electric Utilities Management Program.

Ms. Hernandez's work at SNL varies in topic, scope, and responsibility. It includes work in the Joint Test Assembly division that required use of her background in digital signal processing, telemetry designs, and assistance in running a ground station. Other assignments were as the Environment, Safety, and Health Coordinator for work in Papua, New Guinea's, meteorological station and work in Alaska for the Arctic Radiation Measurement in Barrow, on the North Slope. She was part of the mission-level planning and submission configuration of software and hardware, and a radiation subject matter expert for single-event upset calculations for space vehicles in Satellite and Monitoring planning. Recent Power Engineering work involves Hawaii for Renewable Energy Grid Integration Systems (REGIS) and similar clean energy initiatives that require interpretation of state-specific energy policy, and the Middle East/South Asia International Programs that assist with exploring renewable energy technology options and policies in Non-Proliferation discussions. Energy policy assignments include work with the oil and gas industry for the transportation sector and SNL's national energy-water nexus roadmap.