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BATTERY STORAGE - SET FOR MASSIVE GROWTH

PART III, DETERMINANTS OF FUTURE GROWTH

In Part I of this white paper, we looked at utility-scale energy storage - battery systems being installed and used by utilities themselves. In Part II, we looked at customer-owned energy storage - batteries being installed and used by industrial, governmental, commercial and residential customers.

Here, in Part III, we will look at the various factors that will determine how the future of the trend might play out.

A case in point: While, in the larger scheme of things, it may seem insignificant, in December 2015, the Snohomish County Public Utility District announced that it will be adding a second battery to its already-existing energy storage system. (See Part I of this white paper for information on the original Snohomish project.) What is interesting about this decision is that it highlights the success of the utility's earlier foray into utility-scale storage, and essentially mirrors what is taking place with other utilities (and customers) around the country - continued growth in storage battery installations as a result of the success of earlier projects.

"We have a[n electric grid] system that was designed based on the premise that you can't really store electricity," said Lorenzo Kristov, principal, market and infrastructure policy, for California ISO, in a November 2015 presentation to the Federal Energy Regulatory Commission (FERC). "But now, because of the gains being made in storing electricity, a broad range of energy-related services are possible. Now we can value services, not just kilowatt-hours or kilowatts."

Kristov went on the describe storage as a "game changer" for the utility industry and its customers. In response to Kristov's terminology, FERC Commissioner Tony Clark said that he usually rolls his eyes when he hears the term "game changer," but, in this case, he said, "Dr. Kristov's assessment is correct."

There are at least five components that will determine how much growth large-scale batteries will experience in the coming years, and how quickly they will be integrated into the electric grid:

- Technology Improvements: The outlook is positive.

- Cost Appeal: The outlook is positive.

- Government Support: The outlook is positive.

- Government Regulation: The outlook is unknown.

- Industry Standards: The outlook is unknown.

Technology Improvements

What many people do not realize is that utility-scale battery storage is not new. According to Matt Roberts, executive director of the Energy Storage Association (ESA), a number of utilities got together about 25 years ago and formed what was called the Utility Battery Group. Today, that is now the Energy Storage Association.

"I think there is often a misnomer that these are emerging technologies," said Roberts. However, most of the technologies are 40 to 50 years old. "Even stuff that sounds exotic, such as iron-chromium flow batteries, are NASA technology from the 1960s." The same goes for lithium-ion batteries, he added, saying that they, too, are a relatively old technology.

What has changed, though, is that these technologies are now becoming available to larger numbers of customers. In years past, about the only batteries that available to the public for energy storage were large and expensive banks of low-power deep cell and auto batteries that didn't last very long. As such, they had application only to homeowners, not businesses, and even homeowners weren't that interested in them because of the cost, the size, and the inefficiency. Most homeowners who wanted backup power opted for fuel-powered generators of various sizes and types, which were what commercial and industrial customers were using.

However, in recent years, other battery technologies, while they had been around for awhile (as noted by Roberts), have seen significant improvements in efficiency and reliability, as well as reductions in cost, making them much more appealing for widespread use. One in particular is lithium-ion batteries. (For example, see Part II of this white paper for information on Tesla's Powerwall and Powerpack lithium-ion batteries.)

IN SUM: Technological advances in large-scale batteries continue to progress, a trend that bodes well for growth in battery usage.

Cost Issues

As large-scale battery technology continues to advance, prices for these batteries continue to decrease, which also bodes well for growth of battery usage. According to a September 2015 report published by Moody's Investors Services ("Batteries Charge Up For the Electric Grid"), many lithium-ion battery storage applications could become economically viable by the end of the decade, as long as prices continue to fall. In addition, the U.S. Department of Energy has published a list of expected storage prices and estimates that prices will drop by 50 percent or so over the next five years.

IN SUM: Cost reductions in large-scale batteries continue to occur, a trend that bodes well for growth in battery storage.

State and Federal Programs

Another critical factor in the growth of battery systems is how state and federal governments view the concept. Are they being supportive? Indifferent? Obstructionist? All signs seem to be pointing toward support, and not just passive support, but, in a lot of cases, active support.

"States are really leading the way right now when it comes to the advancement of energy storage," said ESA's Roberts, speaking on a Solar Electric Power Association webinar. "We saw some great federal action that helps launch some energy storage, but there have also been some aggressive programs in the states that are really moving energy storage ahead even faster." He cites some examples: New York and Connecticut are focusing on resiliency and grid modernization, with battery storage being a key component of these initiatives. Massachusetts launched an energy storage initiative that includes $10 million in investments and possible regulatory changes to jumpstart the emerging industry in the state. California has a 1.3 GW energy storage procurement mandate for the state's three IOUs. Hawaii has a goal of 100 percent renewable energy by 2045, and storage is seen as a critical component of this.

IN SUM: Governmental support for large-scale batteries seems strong, a trend that bodes well for growth in battery storage.

State and Federal Regulations

Governments, of course, are multi-faceted entities. It is not uncommon for certain entities within governmental bodies to support something, while other entities within the same bodies end up creating roadblocks. As such, for example, while legislative bodies and some governmental departments may actively support the growth of large-scale batteries, other departments, such as regulatory bodies, may make progress difficult.

In his presentation on large-scale battery trends to FERC in November 2015, Lorenzo Kristov (referenced earlier), noted: "Regulators are not completely in control of the process. We have to figure out how to accommodate this change."

And, according to Jason Burwen, policy and advocacy director for the ESA, in another presentation to FERC, "The power markets run by regional transmission organizations and independent system operators are not often designed to capture the value that storage can offer." Without specific tariff rules for the treatment of energy storage, developers of energy storage projects tend to default to rules for generators, he noted. Burwen added that the ESA encourages FERC to address this gap, for example, by directing RTOs and ISOs to clarify their tariffs to ensure that energy storage can participate in markets on a comparable basis with other resources. "Today, storage has to fit inside existing constructs, such as transmission, distribution, or generation, despite being an essentially different type of asset," he said. Burwen added that FERC "should consider how to incorporate storage into all aspects of grid reliability."

The Energy Storage Association itself is focused on educating federal and state government regulatory bodies on large-scale battery issues. "We are looking at it from the federal level in terms of working with federal agencies such as FERC and others along those lines to create overarching policy structures," said ESA's Roberts. At the same time, ESA is working with the states, and, in fact, has "teams on the ground" in 15 different markets to help address regional challenges or specific market challenges to move things forward.

"We are really trying to get to the point of fairness," said Roberts. For example, if there is an investment tax credit being made available to clean technologies, then it should be able to apply to storage as a stand-alone resource. "Right now, it qualifies if it is paired with a solar system, but it doesn't qualify if it is a block away from that solar system, even though it is providing exactly the same value it was when it was paired with the solar system," he said. "These are inconsistencies that we need to address."

IN SUM: Governmental regulatory bodies are currently a "question mark" when it comes to large-scale batteries. If they fail to come on board, it could slow the growth of the trend.

Industry Standards

Besides governmental regulation of battery systems, another "unknown" relates to industry standards.

While various types of large-scale batteries have been around for decades, most have been used in specific applications (such as by NASA, as explained earlier). However, with the widespread adoption of battery systems being imminent, the industry and various governmental bodies have begun to realize that industry standards to ensure performance (quick ramp-up rates, dependable and consistent power, long-term power, etc.); safety (especially fire codes); uniformity; interoperability (so that batteries can "talk" to each other and to the grid in a uniform way); etc., will be absolutely critical to smooth the widespread growth of batteries, both for utilities and for their customers. "The industry wants to be sure energy storage works well with the technologies that we have deployed on the grid," said ESA's Roberts. "Interoperability - the ability to work on the grid the way the utilities and grid operators expect to - is critical to moving this forward."

While steps toward creating standards are necessary, there is a risk of "too many cooks spoiling the broth." That is, if too many governmental or industry organizations move forward with standards, there will be no uniform standards. For example, New York City currently has a ban on lithium-ion batteries inside buildings, because firefighters want to know how to prevent or contain lithium-ion battery fires. As such, the city is currently working on its own fire standard for lithium-ion batteries.

One national industry organization that is focusing on communications standards, and which has support from a number of large entities, is the Modular Energy Storage Architecture (MESA) Standards Alliance, a California-based non-profit whose

other stakeholders. "Instead of having to write all of the software and make it work with each project, MESA is establishing standards that would provide the framework for how those communications would work," said Craig Collar, CEO and general manager of Snohomish County Public Utility District, who was instrumental in helping to get MESA started. "It will knit together all of the different components."

MESA is designed to foster collaboration among component suppliers, as well as provide shared "lessons learned" among utilities involved in energy storage projects. It is currently working on creating open and non-proprietary communications specifications and standards for energy storage systems. It hopes to have its standards drafted by early 2016.

Governmental agencies are also working on standards, including the U.S. Department of Energy, which has been working on protocols that cover all types of energy storage (including thermal, etc.), not just battery. DOE's efforts pre-date MESA's efforts by three years. In 2012, the DOE contracted with Sandia National Laboratories and the Pacific Northwest National Laboratory to create new storage protocols. A recent paper, "Protocol for Uniformly Measuring and Expressing the Performance of Energy Storage Systems," highlights the progress of the initiative.

Recently, the International Electrotechnical Commission and the National Electrical Manufacturers Association announced that they are now using DOE's protocol as a starting point to draft standards for measuring and reporting energy storage system performance.

So, at this point, while progress is taking place toward the creation of standards, there is a risk that several entities will end up either competing with each other or failing to coordinate with each other, such that the utility industry, the manufacturers that build the batteries and related equipment, and the contractors that install battery systems, will not have uniform guidance on which standards to follow.

IN SUM: Lack of clarity on standards poses a "question mark" when it comes to large-scale batteries. If uniformity does not become evident, it could slow the growth of the trend.

Finley Engineering Company, Inc.
417-682-5531
finleyusa.com