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INTEGRITY INTO EVERYTHING

BATTERY STORAGE - SET FOR MASSIVE GROWTH

PART II, CUSTOMER-OWNED ENERGY STORAGE

In Part I of this white paper, we looked at utility-scale energy storage - battery systems being planned, installed and used by utilities themselves. Here, in Part II, we look at customer-owned energy storage - batteries being used by industrial, governmental, commercial and residential customers. In Part III, we will look at how the future of the trend might play out, particularly as it relates to advances in battery storage technologies, government regulations of battery usage, and industry-created standards for battery storage.

As noted in Part I, utilities see a host of potential benefits of integrating battery storage into their arsenal of "grid tools," including reduction in outages, deferral of capital investments to distribution and transmission equipment, transmission congestion relief, cost savings in electricity production costs, the ability to bring more renewables on-line, and possibly even the elimination of the need for new peaker plants.

However, utility customers also see the potential benefits of battery storage, primarily in two ways:

- One is an option for customers who already have on-site solar, who can now use battery storage as a way to move further "off the grid" the majority of the time - using the direct solar power during the day for their energy needs, and storing excess power in their battery(ies) for use at night.

- The other is an option for virtually all customers, who can use battery storage as a way to rely less on their local utilities during peak demand periods, when energy prices are at their highest. This option is particularly appealing to industrial and large commercial customers, who are very sensitive to fluctuations in energy prices. In other words, their on-site batteries can store power at night, when rates are low, and then use that stored power during certain times of the day, when rates are higher.

Combined Solar-Battery Storage

In 2014 and 2015, the Rocky Mountain Institute (RMI), HOMER Energy, and CohnReznick Think Energy published a two-part report titled "The Economics of Grid Defection."

The report noted that the continued decline in the costs of solar PV and battery storage, coupled with increasing retail electricity prices, have resulted in grid parity today for commercial customers. The report also predicted the potential for "appreciable customer defection" from major markets by 2025, without incurring higher costs or lower reliability, as a result of the growing trend of solar installations combined with battery storage. Migration of customers away from the grid could happen well within the 30-year planned economic life of typical utility investments such as central thermal generation plants and transmission infrastructure, according to the report.

"Solar-plus-storage represents a fundamentally new paradigm," said John Creyts, Ph.D., managing director of the RMI. "While other distributed generation options still require some degree of grid dependence, solar-plus-storage provides an opportunity for customers to cut the cord to their utility entirely."

"No matter how expensive retail electricity gets in the future, customers that invest in these grid-connected systems can contain their electricity costs at or below a 'peak price,' yielding significant savings on their monthly utility bills," said James Mandel, a principal with RMI and co-author of the report.

According to the report, even if only a fraction of customers adopt such systems, utilities could face lost kWh sales from central generation, potentially undermining revenue needed for ongoing grid investment and maintenance. The report added that the likelihood of favorable long-term customer defection signals the eventual demise of traditional utility regulatory models.

The "Game-Changing" Customer Battery

While batteries have always been available to customers for storage, they have primarily been bulky and expensive units, designed primarily for occasional use, such as during power outages. As such, customer interest was miniscule. Instead, customers who wanted to protect against power outages tended to opt for fuel-powered generators.

However, that of all changed on April 30, 2015, when Tesla Motors, a manufacturer of electric vehicles, announced that the company was releasing a new line of stationary rechargeable lithium-ion batteries for homes and commercial buildings, designed to store energy so that it can be used when energy is unavailable (such as during a grid power outage) and/or when grid energy is more expensive (such as with solar panel storage applications).

The battery, called the Powerwall, costs approximately $3,500 for a 10kWh unit, which is a size that is optimized for serving a home if the power grid goes down. A less expensive model, a 7kWh version for $3,000, is designed for managing the fluctuations in power to houses that are served by solar panels.

A customer (a homeowner or commercial building owner) can purchase and install up to nine 10kWh Powerwalls (to achieve a 90kWh output), or nine 7kWh Powerwalls (to achieve 63kWh output).

Each battery comes with a ten-year guarantee (renewable for another ten years), as well as some integrated software

that provides thermal regulation, safety checks, and energy optimization. "It will be connected to the Internet, so we can create smart microgrids," said Elon Musk, CEO and co-founder of Tesla Motors, in a press release on that day.

Units began shipping in late summer 2015. "Our goal here is to fundamentally change the way the world uses energy at the terawatt scale," said Musk. "The goal is complete transformation of the entire energy infrastructure of the world."

Use of Tesla batteries may actually expand beyond just residential and small commercial, though. In November 2015, the Inland Empire Utilities Agency in California, a water and wastewater utility, announced a water-energy project that will use advanced energy storage systems, including Tesla's Powerpack batteries (which, unlike Tesla's smaller Powerwall batteries, are larger utility-scale batteries designed to store off-grid energy). These advanced storage systems will integrate wind, solar, biogas, and grid resources. The project is designed to optimize renewable generation, reduce demand on the electric grid, and reduce energy costs.

The first part of the Inland Empire project will involve installing approximately 3.5 MW of advanced energy storage systems at one of its regional water-recycling facilities and pump stations. The batteries will store excess renewable energy and use the stored energy to power facilities when demand on the electric grid is high, providing an estimated 14 percent reduction in grid energy usage and a reduction of total energy costs by between five and ten percent. The energy storage systems will also provide an added layer of protection against outages and enhance the utility's ability to share the benefits of renewable resources between facilities.

Response Strategies for Utilities

Are there steps utilities can take to stem the tide of customer defections as a result of advancing storage technologies and more attractive pricing of the storage? Indeed there are. One of the most effective ways is to become an actual participant in the market, rather than remain a passive and helpless onlooker.

"This is not all risk," said Leia Guccione, an RMI manager and a co-author of the two-part report cited earlier. "Because these solar-plus-battery systems are grid-connected, they can offer value and services back to the grid. We need not see them only as a threat."

According to the report, the evolution of retail pricing structures, utility business models, and regulatory frameworks will largely guide that evolution and set the grid on one of two major possible trajectories. "Down one path are pricing structures, business models, and regulatory environments that favor eventual grid defection," said Jules Kortenhorst, CEO of RMI. "Down another road, those same factors are appropriately valued as part of a transactive grid with lower system-wide costs and the foundation of a reliable, resilient, affordable, and low-carbon grid of the future in which customers are empowered with choice."

"To remain competitive, utilities need to understand how to leverage hybrid systems within the electricity system," said RMI's Creyts.

"As storage and control technologies improve, we have the opportunity to incorporate more and more renewable energy sources into the grid as a way that balances and optimizes those power sources," said Peter Lilienthal, Ph.D., CEO of HOMER Energy. "Properly regulated, these hybrid technologies can be a benefit to the larger grid, rather than a threat as they are sometimes depicted."

For one innovative example of how utilities are participating in this trend, see another Finley white paper on Fort Collins Utilities.

Glasgow Electric Plant Board

There are other innovative and proactive ways that utilities can participate in the trend toward customer energy storage, rather than sit on the sidelines and watch helplessly as more and more of their customers defect.

One utility taking steps in this direction is the Glasgow (Kentucky) Electric Plant Board, a municipally-owned electric utility which is installing Sunverge Energy's smart energy storage devices as part of its efforts to reduce emissions by 25 percent, primarily by reducing energy production during times of peak demand. What is particularly innovative about this project is that it is not dependent on the storage being coupled with on-site solar generation.

In specific, the Sunverge system, which is defined as "intelligent storage," is being installed in 165 homes in Glasgow, a town of 14,000 people. It provides utility-grade storage at individual homes, along with "in the cloud" software, so that the storage can be remotely managed. The storage devices capture power from the electric grid at night when demand and cost are low, and then, during certain times of the day when peak demand and costs are higher, the utility can remotely activate the batteries in the homes to release the stored power in the batteries, reducing the need for the utility to supply additional power from traditional generating plants.

In sum, as is the case with Fort Collins Utilities (referenced earlier), Glasgow Electric Plant Board is fully involved, and actually in charge of, customer storage technologies.

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