Utility Transformation: Energy Storage – The disruptor from the edge

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Meet the Author:

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Let us continue to use the hypothetical case study from an earlier article.

"I just returned from Houston and my friend got a message on her cell phone that the power was out at their house, but that it would be back on in 2 hours, so we kept playing tennis. When she checked the app, she also showed me her car was only charged 80% but it was ok, because she was using her solar cells to charge it and it would be complete in 3 hours. She smiled and said she sold $75 worth of power last month back to her retailer and it paid for lunch today. She said her electricity bill now only includes a connection charge unless she does her clothes washing and baking on the same day. I am calling PSE to see what they can provide."

Case credit to Charles Filewych, CEO, Smart Grid Interconnect. Used here with permission

Using this same case study, let us focus on another aspect of utility transformation – Energy Storage. Electric Energy Storage (EES) is set of technologies capable of storing previously generated electric energy and releasing that energy later. It uses forms of energy such as chemical, kinetic, thermal or potential energy to store energy that will later be converted to electricity. So, what does this mean?

- *Electric Energy Storage Mechanisms:*
  - *Energy can be stored using a variety of mechanisms that cover Chemical, hydro (potential energy), flywheel (kinetic), thermal and other new and innovative mechanisms to store and discharge pre-generated energy.*
- *Charge/Discharge Capacity:*
  - *The mechanisms to store and discharge energy also drive the potential applications of this specific storage mechanism that can range from high energy to high power.*
- *Speed of discharge:*
  - *These same mechanisms that determine energy versus power also drive the charge/discharge rates. Examples such as flywheel storage can deliver energy extremely fast can be used to provide regulation support to the grid whereas Li-On-based storage mechanisms are used in cars and buildings to deliver a lot of energy over a sustained period.*
- *Scale/Size of storage:*
  - *The type of storage mechanism also determines the scale to which these devices can size up in terms of energy and/or power delivery. Examples of pumped hydro can deliver power in the 100s of MWs over a sustained period whereas flywheels deliver multiple MWs of power in very short periods of time.*

Who are the users here?

Like DERs from the previous article, storage mechanisms can be installed and used by a broad range of stakeholders

- *Generation and independent power producers: These are the owner-operators of the power plants and especially when it is a pumped hydro plant, can both generate and/or store energy. The decision to either generate or store energy is made by the operator based on economics.*

- *RTO/ISOs: Wholesale market operators use storage mechanisms to such as flywheels to provide localized sources of regulation support where needed and get around congestion zones.*

- *Individual customers (residential and/or commercial/industrial): The entry of systems like the Tesla PowerWall have also thrust the residential customers into the limelight. Storage mechanisms provide an alternate mechanism for the customer to offset their solar/PV installations by storing energy when it is more than their localized needs and discharging at night when the sun is not shining*

- *Utilities: In many states, utilities can install storage to avoid substation enhancements and defer capital expenditure. By installing storage, the utility can smoothen out the load thereby reducing the need for peak infrastructure support.*

Conclusions and Closing Thoughts - How does the utility transform itself with these Disruptors from the edge

The future in this area is moving more and more towards increased penetration of DERs in the utility most of which are coming from customer installations. The variability of power generation from these DERs is already causing perturbations and quality issues at the utility from an operations perspective. It is to be expected that as the penetration of DERs from renewables increases, the operational problems will also increase.

Enter the disruptor – Storage. These have multiple uses:

- *Power Quality: To assure continuity of quality power and smoothen out the variability of power from the DER.*
- *Bridging Power. To assure continuity of service when switching from one source of energy generation to another.*
- *Energy Management: To decouple the timing of generation and consumption of electric energy. Load leveling, which involves charging of storage when energy cost is low and discharging when cost is high.*

The utility industry is transforming itself from the present one-way flow of energy from a centralized set of a few large generators to a distributed world in which a significant percentage of generation comes from large numbers of small generators distributed across the grid.

Storage is the disruptor which will allow this transformation to happen.

Author's note: This is a part of a series of articles written by this author for Intel. This is the Fifth article and the next set of articles will continue the focus on expanding on the concepts introduced in the first and second articles.