Reinventing Demand Response with Behind-the-Meter Energy Storage

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Topic: Demand Response

Demand response (DR) is critical for reducing peak demand on the grid and, at the same time, avoiding system emergencies. When delivered via behind-the-meter energy storage, DR can play an even more significant role in improving reliability and reducing system cost.

Behind-the-meter battery storage is gaining popularity among commercial and industrial businesses as a cost-effective solution to reduce peaks and manage demand charges. This market is predicted to grow rapidly: according to GTM Research, over 700 MW of distributed energy storage will be deployed in the U.S. between 2014 and 2020.

As systems come online, utilities have an opportunity to leverage this distributed resource in a variety of ways to provide value to all their customers.

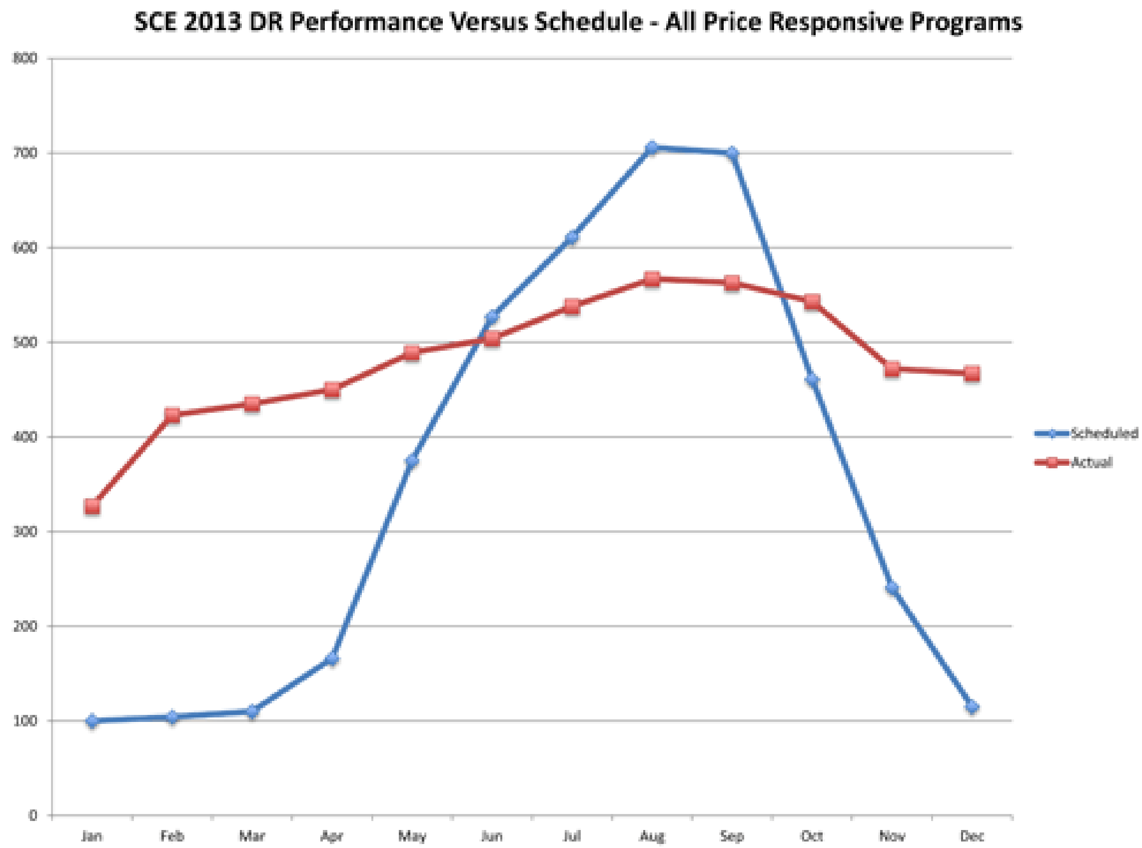
A New Approach to DR

Behind-the-meter battery storage offers an enhanced DR choice in three ways:

1. **Speed**: With no loads to wind down or generators to spin up, reduction in demand occurs nearly instantaneously. This eliminates the need for utilities to declare DR events hours or a full day ahead, and also enables a more rapid and effective response to anomalous conditions occurring on the grid. Some energy storage systems are even capable of sensing and responding to such anomalies autonomously and instantaneously[1].

2. **Dependability:** The dependability or "firmness" of energy storage as a distributed energy resource in terms of its power, performance and location improves on traditional DR. With distributed energy storage, there is a precise, measurable amount of power available to grid needs. This precision enables grid operators to schedule other resources with certainty, which leads to lower resource costs. Conversely, traditional DR runs the risk of over- or under-estimating customer response.

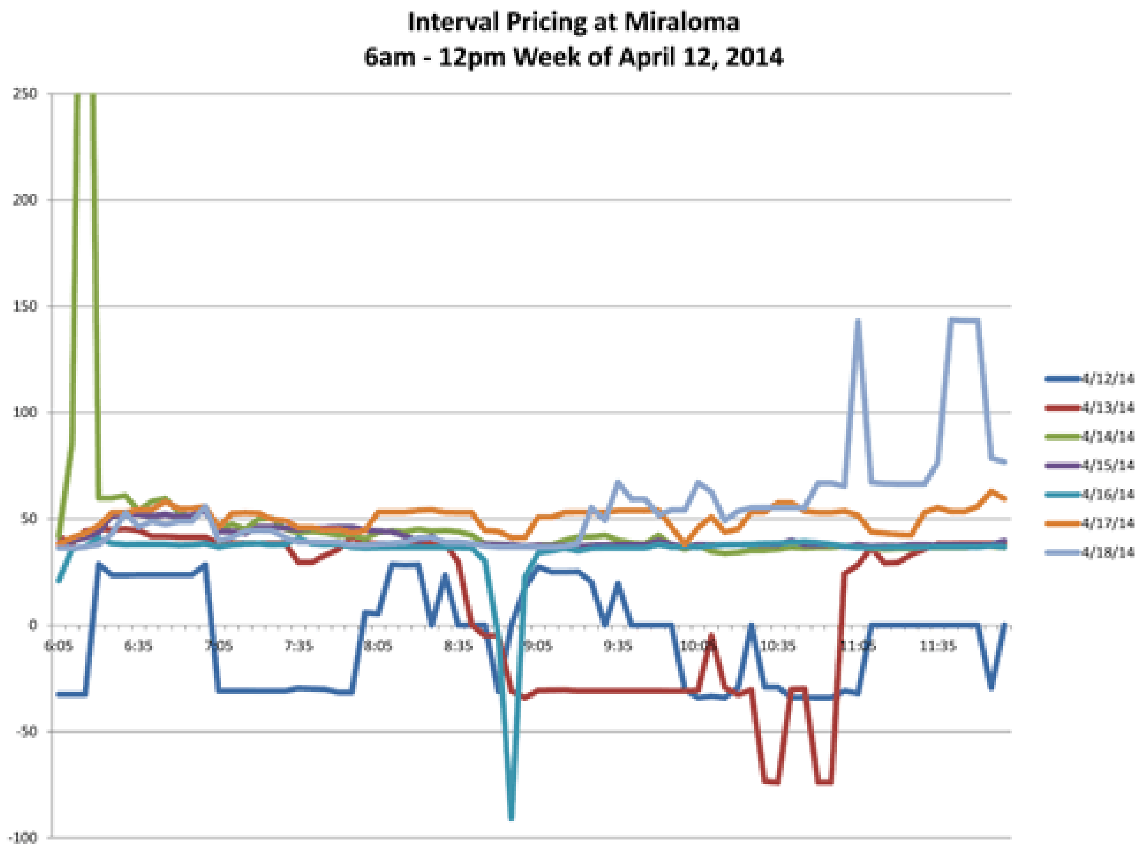
The graph below displays performance data from 2013 Southern California Edison DR programs. When averaged over the year, price responsive DR performed as expected, but during the summer these programs underperformed by 20%. The difference between what was promised to the grid and what was delivered must be made up by other generators, adding cost and pollution.



Measuring performance is also a key differentiator with distributed energy storage. While traditional DR relies on after-the-fact baseline methodology, comparing customer load from previous days to the event day, energy storage gives real-time data on how the system is actually performing. Again here, performance data gives grid operators certainty, further lowering system cost.

The firmness of battery-based energy storage also increases how frequently it can be called as a DR resource. With such a dependable and non-disruptive DR asset, there is little or none of the usual "customer fatigue" that results from more frequent DR events. Utilities can be assured that during situations such as a heat wave or a "Polar Vortex", or even a prolonged problem with generation or transmission, they will be able to continually draw from storage during peak hours. An analysis of DR calls in PG&E territory for the last three years indicates that 87 percent of calls were multi-day DR events.

3. **Managing over-generation:** Traditionally, DR's role has been to reduce demand to avoid exceeding available or high priced generation. But another form of grid instability occurs more frequently when power from renewable resources exceeds demand. Prolonged periods of over-generation can result in negative pricing in wholesale markets, a phenomenon that is already occurring in California and Texas. Batteries have the ability to both decrease and increase demand, responding to over- and under-generation scenarios.



This bi-directional, energy-conserving mode of operation makes energy storage unique as a DR resource. In effect, this new type of DR serves to time-shift excess generation to when it is needed the most: during periods of high demand. This will become critical as the penetration of solar and wind generation increases, causing both the frequency and severity of short-term imbalances occurring on the grid to increase.

The only "solution" to the renewables intermittency problem today is curtailment - temporarily removing these or other generating sources from the grid when generation exceeds demand. But to fulfill renewable portfolio standards (RPS), regulators will need to insist on a better solution-one that enables generation whenever the wind blows and the sun shines independently of the current demand. The rapid response, firmness and bi-directionality of batteries combine to provide that better solution for mitigating all imbalances on the grid, whether caused by too much or too little demand.

Win/Win with Energy Storage

Behind-the-meter energy storage is a beneficial distributed energy resource for both utilities and for their commercial and industrial customers. The win/win nature of this powerful and increasingly popular configuration is destined to have a profound impact on the way energy is consumed (and generated), and is already driving changes in regulations. Consider, for example, the FERC orders for DR and ancillary services pricing, and the California Public Utility Commission-a state with a particularly ambitious RPS-now including customer-sited storage in its procurement targets.

Behind-the-meter storage provides a great compliment to traditional DR, offering faster response, greater dependability, and less customer intrusion. As distributed and renewable generation continues to gain market share, aggregated behind-the-meter storage can provide a resource to improve customer and utility economics.

[1] http://www.stem.com/wp-content/uploads/2014/04/stem-Distributed-Load-Shedding_IEEE_2014.pdf

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