Why smart grid technologies matter in the data center

In 2010, data centers accounted for about 2 percent of total U.S. electrical consumption – up a third from 2005, according to Jonathan Koomey of Stanford University's Steyer-Taylor, Center for Energy Policy and Finance.

Given the constraints of the power grid, data centers are essentially competing to get the power they need, and they'll find over time that maintaining an adequate and reliable supply of electricity only grows more costly and difficult.

That's why data centers are so aggressively seeking ways to improve efficiency, manage consumption and optimize the use of energy. At the heart of this effort are smart-grid capabilities – from self-healing networks to distributed energy resources to open marketplaces for buying and selling electricity, says Gary Rackliffe, VP-Smart Grids North America at ABB.

The smart grid concept is often misunderstood, according to Rackliffe. It's often assumed to pertain only to utilities. But as the integration of utilities and data centers becomes more sophisticated, deployments of smart grid technologies in the data center are growing.

The desire for such innovation is what's driving demand for Data Center Infrastructure Management (DCIM) systems, which provide the core requirements of the smart grid: real-time data, intelligence to analyze it, and automation to put it to use.

Here, according to Rackliffe, are some key examples of how DCIM systems allow data centers to optimize how electricity is used:

Controlling energy load

Late in 2012, a special report by The New York Times stated: "Most data centers, by design, consume vast amounts of energy in an incongruously wasteful manner... Online companies typically run their facilities at maximum capacity around the clock, whatever the demand." While figures cited in the report have been disputed, this point is not: In

maintaining high levels of reliability, data centers have been living with large inefficiencies in consumption of electricity.

DCIM enables data centers to implement a range of demand response techniques that tackle this issue, such as:

- Peak shaving to avoid power demand spikes that may incur penalty rates for electricity;
- Reducing load on request when the utility faces especially high demand or to offset utility spinning reserve requirements;
- Load shifting that moves data center activity to off-peak hours or to other physical locations where momentary demand for power is lower;

When combined, all of these techniques serve to reduce a data center's overall demand – having the same effect on the grid as an increase in capacity.

Virtualization

Just as virtualization of servers helps to increase utilization of existing IT capacity, a Virtual Power Plant (VPP) increases utilization of electricity. A VPP combines all of a data center's demand response resources – along with other pieces of the electrification network (diesel generators and uninterruptible power supplies, for example) – so energy saved or stored in one area can be quantified and used wherever else it's needed as if it was newly generated electricity. A VPP also can encompass a microgrid – a self-sufficient power network capable of operating in isolation from the electrical grid, and a helpful tool in harnessing distributed energy resources such as solar and wind power.

Once established, a VPP allows fast and reliable decision-making for when to call on distributed energy resources – or even when to sell dispatchable power back to the grid. It facilitates participation in energy markets that can reduce costs and increase flexibility of power supplied.

Converting to direct current

Direct current has always figured heavily in data center operations, and an increasing number of facilities are looking at building all-DC or hybrid AC/DC operations because:

- DC data centers use less energy by reducing the number of necessary conversions/transformations;
- They create 25 percent less heat, reducing cooling costs;
- They can cost less to build – requiring 25-40 percent less square footage for power-related equipment, and lower equipment and installation costs;
- They offer increased reliability due to fewer components and elimination of load bus synchronization and complex controls.

Rackliffe acknowledges that applying these capabilities requires significant investment, education and time. And not every smart grid innovation is right for every data center today.

"Building the smart grid is like the process of optimization itself; it's never really finished," Rackliffe says. "But if you're waiting on the sidelines now you're getting behind. No matter how large or small your operation is, one or more of these capabilities is going to pay off now – becoming the foundation of your competitiveness in the future."

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