Why data centers are suddenly hot on solar energy

Apple Corp. made headlines earlier this year – not just for the latest iPhone release, but for its plans to build a 20 MW solar array to power its newest data center in Reno, Nevada. The company already has a data center in North Carolina that gets 60 percent of its power from a similarly-sized solar array.

And Apple isn't alone. In an effort to reduce carbon footprints and increase sustainability of operations, dozens of companies – notably Facebook, eBay and Cisco Systems – are implementing large solar projects to power their data centers.

The movement to solar isn't limited to giants of the Internet, nor is it limited to sunbelt locations; McGraw-Hill is building a 14.1 MW facility in New Jersey, according to Rich Miller at Data Center Knowledge. And Rutgers University, also in New Jersey, is experimenting with a small roof-top array to power a 150-server micro-data center.

Conventional wisdom says solar power is too expensive and too intermittent for meaningful application by data centers.

But that wisdom is changing quickly; While long-term projections call for carbon-based power to continue rising in price, technology is making solar power easier and more cost-effective to tap.

Today, according to Pablo Astorga, Solar Business Development Manager at ABB North America, the technical challenges data centers face in using solar power fall into two broad categories: reliability and quality.

Reliability: Because of solar power's intermittency, data centers must be prepared to store it or supplement it. "We're not necessarily talking about battery storage for large amounts of energy to run the data center overnight; that would be very expensive," he notes.

Instead, centers typically use electricity converted from solar energy to power daytime operations, and apply any excess to such peripheral requirements as charging charge UPS (uninterruptible power supply) systems.

But even the most ambitious projects that aim to be entirely self-sufficient and green must find other power supplies; Apple's Nevada center will be supplemented with geothermal energy, while its North Carolina facility uses biogas. And because they are designed to sell excess electricity onto the grid, they will also have the ability to draw from it if needed.

So the challenge isn't in finding alternatives to supplement solar power, but in having the visibility, system intelligence and precise control to optimize the use of each power source.

That is one driver of demand for DCIM (Data Center Infrastructure Management) solutions such as ABB's Decathlon. These systems provide real-time data on energy usage with embedded intelligence to allow decision-making and automation that keep the data center fully powered from a portfolio of energy sources.

Quality: The other issue data centers must address in order to protect sensitive IT assets is power quality. A range of solutions have already been tested and proven in the utility sector, such as ABB's PowerStore, a compact flywheel-based generator designed for use in microgrids to stabilize against fluctuations in frequency and voltage. It includes state-of-the-art inverters and virtual generator control software, enabling the integration of intermittent renewable generation.

The appropriate combination of stabiliziation technologies will depend on a data center's unique design and requirements, and can be developed with help from an experienced service provider, Astorga says.

Because reliability and quality can be addressed through technology, the remaining challenge is how to integrate it cost-effectively.

According to Katie Fehrenbacher in GigaOM, the price of solar panels has decreased steadily and in some commercial arrangements is providing provide electricity for 13 to 30 cents per kWh. She further cites Bloomberg New Energy Finance in reporting that some projects currently in development expect to deliver solar-generated electricity for as little as 9 cents per kWh by 2016.

But data centers can do more than wait for prices to drop. Aggressive application of DCIM, virtualization of power supply and other smart grid technologies introduces a range of efficiencies that can reduce day-to-day operating costs now, while increasing responsiveness and flexibility to changing conditions in the data center as well as in energy markets.

The result is that solar power can be introduced today as part of a more sustainable and renewable energy portfolio that reduces the future rate of increase in energy costs.

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