
Future proofing data centers for a sustainable tomorrow

Dave Sterlace from ABB discusses why despite massive gains in efficiency, data centers can do even better with new technologies to make every watt count

Twenty five years ago, when ABB entered the data center sector, the major considerations for our customers were uptime and reliability. That quickly evolved.

Starting in 2007, following the publication of the US EPA's Data Center Energy Use Report to Congress, rising energy consumption of data centers also became a major concern. Thanks to significant efficiency gains in IT and OT, predictions of soaring energy usage of data centers in the coming decade turned out to be far from reality.

Today, the combined use of electricity by data centers in the U.S. for example amounts to just 2 percent of the country's overall energy usage. This is about the same level as data centers consumed in 2006, making this a remarkable achievement considering internet traffic has risen more than fivefold, and data center workloads have tripled with the explosive growth in smartphones and cloud infrastructure.

Running data centers at higher temperatures and using virtualization to cut down on underutilized servers have played a key role in this efficiency gain over the years. In addition, the industry's move towards larger and more efficient hyperscale centers has helped, because these centers consume much less energy for cooling as compared with their smaller counterparts.

On average, one server in a hyperscale center is said to be able to replace 3.75 servers in a conventional center with a 2016 report from the Lawrence Berkeley National Laboratory estimating that energy usage would drop by a quarter if 80 percent of servers in small U.S. data centers were moved to hyperscale facilities. This has driven the shift to colocation and multitenant data centers from a cost and sustainability standpoint.

Moving to ultra-efficiency

Energy efficiency achieved until now, outstanding as it is, isn't enough. Data center operators feel the pressures of sustainable stewardship to continually improve. Computationally intensive applications such as video on demand, autonomous vehicles and advanced 5G technologies are growing in popularity, driving the increase in data center demand and energy consumption. To deal with this surge, data centers will need to become even more efficient. At such ultra-efficient data centers, every watt counts.

For data center operators, the most important consideration is still to maintain business continuity, which means running uninterrupted 24/7, 365 days a year. Increases in efficiency cannot jeopardize availability. Since the most common cause of outages in data centers is power supply problems, the ability to balance the need for uninterrupted, reliable and efficient power is critical.

Resilience versus sustainability

A key solution in driving out energy losses is advanced Uninterrupted Power Supply (UPS) systems, where enhanced power measurement allows the data center operator to accurately track energy consumption. By using decentralized parallel architecture (DPA), modules that are not needed are intelligently switched by the UPS to a standby mode, ready to transfer back to active mode if demand increases. In the case of a power failure, all modules become active within milliseconds. Along with other support infrastructure such as smart sensors, intelligent switchgear and predictive maintenance algorithms, the UPS delivers a high system resilience alongside more sustainable operations.

Another technology that can help make data centers incrementally more efficient and sustainable are gas insulated switchgears (GIS). Compared with traditional offerings, GIS offer a lower lifecycle cost. This is possible because of their compact design and reduced frequency and cost of maintenance, which in turn minimizes operating costs and downtime risk. GIS can also be commissioned more quickly and can deliver a more sustainable solution – in particular those versions which do not use SF₆, a greenhouse gas popular in the industry.

Digital solutions to realise green gains

As the industry continues to demand more sustainable operations, Data Center Automation will also be key in achieving this objective. Given the industrial scale and criticality of today's data centers it seems natural that industrial-grade automation systems should be used to monitor and manage operations.

Industrial automation systems are robust and highly hardened systems that can scale from small to extremely large and from simple to extremely complex. They are designed to talk to all kinds of equipment using many different protocols and are used in continuous operation over long periods, even while being upgraded.

By enabling inefficient power and water usage to be identified and automating reporting to track progress and compliance, digital energy management solutions can facilitate the reduction of a facilities energy usage. In the case of Lakeland Community College, they were able to leverage data center automation to identify cooling inefficiencies and forecast the impacts of layout and capacity changes to reduce the facility's energy usage by more than 50 percent.

Every Watt Counts

While technologies and operating practices implemented to date have successfully stabilized the energy consumption of data centers, the stakes have undoubtedly been raised. Today it is no longer enough to prevent further increases in energy usage, the aim is to achieve carbon neutral or negative data center operations, often within a very limited time frame.

Drawing on the latest innovations in power distribution and energy management will be key in delivering future proof, sustainable data center operations. No single technology can solve the challenge alone, it will take an ecosystem of fully integrated and intelligent solutions to realize this objective, evidence indeed that every watt counts.

