



KPMG ANALYSIS

Companies Taming Power-Hungry Data Centers

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By Dave Pelland, Managing Editor, Technology Insider

Companies and IT vendors are looking for ways to reduce the voracious -- and increasing -- electricity demands of data centers.

Corporate data center priorities have long been centered on ensuring that equipment runs smoothly in brightly-lit and temperature-controlled facilities, but with energy supplies shrinking and electric rates rising, energy costs have become a focus.

According to Paul Scheihing, technology manager for the U.S. Dept. of Energy's Industrial Technologies Program, data centers are prime candidates for power-reduction because the average data center, packed with servers and cooling equipment, uses 10 to 100 times more energy than the typical office building, which uses an average of 90.5 Btu per square foot, according to the U.S. Energy Information Administration.

Scheihing, speaking at the DataCenter Dynamics conference in Bethesda, Md., said small investments in conservation can help companies improve the operating efficiency of their data centers, and help prevent shortages in cooling or computing capacity that require equipment upgrades.

"Energy efficiency is about the optimal use of capital and technology in a way that can extend the life of equipment and give [companies] more use for less cost," Scheihing said.

Stephen P. Mathis, director of corporate facilities and services for Fannie Mae, said over the last four years, rising electricity costs and growing attention to environmental issues have prompted companies to examine better ways to operate data centers.

"A lot of companies are asking how we get this high-density [equipment] running and get the efficiencies our CEOs are asking for," Mathis said.

Andrew Fanara, manager of the product specifications development team for the U.S. Environmental Protection Agency's (EPA) Energy Star program, said growing computer use, especially high-density server racks found in data centers, has increased electricity demand.

According to the U.S. Energy Information Administration, commercial-sector electricity use rose 38 percent between 1995 and 2005. And an EPA draft report for Congress estimates data centers account for 1.5 percent of all electricity consumed in the United States. This is expected to reach 2.5 percent in 2011 if current trends continue.

On the cost side, Fanara said demand for electricity is rising faster than the nation's capacity to generate it, leading to higher prices. For example, in 2005 utility rate increases ranged from an average of 9 percent in the southeastern United States to nearly 16 percent in Texas, Oklahoma, Arkansas and Louisiana.

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"The power grid is constrained," Fanara said. "Billions of dollars need to be invested in the grid to make it more reliable, and that comes at the expense of ratepayers and leads to higher prices."

Technology companies are responding with numerous ways to reduce electrical use without undermining computing capacity.

Since its founding in February 2007, at least 43 companies, including AMD, APC-MGE, Dell, HP, IBM, Intel, Microsoft and Sun Microsystems, have joined the Green Grid, a non-profit consortium focused on improving data centers' energy efficiency. The group plans to develop standards, metrics and other initiatives to help reduce data center electricity use.

Scheihing said large companies, universities and government agencies are all pressing technology and facilities suppliers for ways to reduce energy use and costs.

"There are tremendous business opportunities for those of you that provide products and services to this market," Scheihing said.

Instead of the traditional approach of trying to maintain a chilled environment throughout a data center, data center managers are instead directing their cooling equipment to specific rows and server racks.

Jesse Hanz, an enterprise segment regional manager for APC-MGE, said companies are matching cooling equipment with the hottest areas in a data center, and adjusting their cooling equipment as servers' computational loads rise and fall.

"The ability of the power and cooling systems to handle IT loads with both high-density and dynamically varying power will soon become mandatory," Hanz said. "Companies don't want to flood a room with cold air [anymore]."

Ken Baker, a data center infrastructure technologist in HP's scalable data center infrastructure group, said because data center managers are primarily concerned about keeping servers operating if cooling equipment fails, they often reduce the temperature far lower than necessary.

According to Baker, servers are designed to operate effectively with a server-rack air inlet temperature between 68 and 72 degrees Fahrenheit, but many data centers are cooled to an inlet temperature as low as 50 degrees to prevent overheating if a nearby air conditioner fails.

Baker said this approach is expensive because cooling equipment can account for two-thirds of a data center's electricity bill.

"We have to become more sensitive to temperatures today because of the cost and the energy content being devoted to wasteful cooling over-provisioning," Baker said.

Baker said it's becoming important for companies to view data centers as contained ecosystems and to follow accepted practices such as aligning server racks with cooling equipment, because servers are designed under the assumption those practices will be followed.

"If you open a server and look at the way things are arranged, there's an electrical

relationship and there's a thermodynamic [relationship]," Baker said. "We put the drives and processors in front so they get cold air first. The server is designed so that we know, for every component, the temperatures that device is going to see."

HP is releasing technology that links data center cooling equipment fans with temperature sensors in specific server racks. If servers are operating within normal ranges, the fan speeds can be reduced, resulting in energy savings.

"A great deal of energy conservation is possible when you modulate the fan speeds," Baker said. "You generally don't have to run the fans at full speed. You have to run them at full speed if the [heat] loads go near the thermal limits, but loads [usually] don't go there."

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