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Helping Data Centers Run Lean

By Phil Britt

The Environmental Protection Agency estimates that utility costs for U.S. computer servers rose to $7.4 billion in 2010, up from $4.5 billion only five years earlier.

As data use mushrooms due to the growth in text messaging, video, audio, and other information, the demands on data center equipment grow – meaning more power to operate and to cool the servers.

In addition to attempting to control costs, data centers are seeking greener operations because some are in areas, like in San Francisco's central business district, that have no more available power. Even in those areas where power is relatively abundant, there is recognition that the costs and demand curves are continuing to increase quickly, so conservation methods are necessary to slow down the growth.

The power demand issues are not limited to the U.S. Even in France, where less expensive nuclear power is abundant and relatively inexpensive, companies such as Warsaw-based Comarch are employing power conservation strategies in building data centers.

"Since 2009, we have observed a significant increase of interest in investing in IT centers. A few of the reasons are an explosion of smart phones, video and mobile application, inflation of corporate data, overflow of existing servers, growing outsourcing market in services and externalizations, trends associated with SaaS and cloud," says Marcin Florek, Comarch Project Manager.

Strategies to continue to meet the demand for processing power while attempting to be as green as possible include virtualization and equipment upgrades, hot air containment, running data centers "hotter," using an increasing amount of natural air cooling, and increased use of renewable energy resources.

Prior to 2004, data centers were kept at relatively low temperatures, around 68 degrees, per recommended guidelines from the American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE). In 2004, ASHRAE raised those guidelines to 77 degrees. After further study in 2008, the ASHRAE raised the recommendation to 81 degrees, and now is looking to raise the recommendation even higher.

Virtualization helps by cutting the number of servers by as much as a 10-1 ratio – reducing the floor space needing to be powered and cooled while also operating the remaining servers more efficiently, says Bill Kosik, HP Technology Services Principal Data Center Energy Technologist. Older, not-virtualized servers still consumed energy even when operating at very low levels, meaning wasted energy.

"We took an approach, as a whole, to look at what is driving energy waste," adds Ron Mann, HP Director of Engineering, Data Center Infrastructure. "Many companies just stop at the rack. We looked at anything that caused inefficiencies, from the UPS to the conversion technology to redundant power supplies."

Among the discoveries that HP is using in designing new data center facilities was that indirect cooling and variable speed fans permitted more efficient temperature control. More efficient UPS and conversion systems reduced power loss when converting from AC to DC power. Monitoring and automated systems power down systems when underutilized or not in use.

Another energy efficiency technique data centers use is better containment for hot air, according to Jason Yaeger, Director of Operations for Online Tech, which operates a couple of small collocation data center facilities in Michigan. Among the facilities' clients are a couple of telecom resellers.

Keeping hot and cold air separate is a long-standing practice. Data centers seek to eliminate the hot air as quickly as possible so they don't have to re-cool it. But historically, there had been too much air flow between the hot and cold air aisles, according to Yaeger. So Online Tech sealed unused panels in the data center racks and installed barriers on top of the racks to help prevent any warm air leaking back into the cold air area. A similar temperature containment strategy was employed in Comarch's design for a new data center in Lille, France, the company plans to open by the end of the year. The facility will include a system to pump water directly into the raw exchangers inside the boxes and transform chilled water into cold air to cool the racks.

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Similarly, HP's Wynyard, UK facility which opened in February 2010, leverages the cold climate in the North East of England for cooling IT equipment and plant rooms. A large quantity of fresh air is supplied by fans and filtered, reducing the energy required for cooling by 40 percent compared to conventional data centers. The building also features an energy-efficient and sustainable design that incorporates recycled materials as well as harvested rainwater.

So-called natural air cooling is also more prevalent in the U.S., a phenomenon driven by growing energy needs and recognition that data centers can run at warmer temperatures than once was thought to be prudent. Improved filtering and monitoring of filtering systems helps to ensure exterior particulate matter doesn't damage internal systems. However, enclosed data centers still provide better protection against the outside contaminants.

Renewable Resources

Data centers are using a variety of renewable resources in an attempt to be greener. But in most instances, even the most aggressive of those efforts result in only about a 10 percent reduction in energy needed from other sources:

Emerson Electric has solar panels covering "every square inch" of its St. Louis, Mo. data center. But, the solar energy represents only 13 percent of the facility's power needs.

Under an agreement with SunPower, HP will install its first-ever, large-scale power installation at its San Diego facility. Once completed, it will transform sun into 1. MW hours of electricity – which is enough to provide more than 10 percent of the facility's energy, which the company estimates will save approximately $750,000 in energy costs during the next 15 years. "As solar technology becomes more advanced, it will be a more viable source of power for data centers," said HP's Cosick.

ACT, providers of the well-known college entrance exam, employs a geothermal system that helps cool the firm's 10,000-square foot facility in Iowa City, saving about 30 percent on total power needs.

Use of renewable resources is largely geography dependent. While facilities in the Midwest can get some benefits from wind and solar, geothermal and hydroelectric sources are more abundant in other parts of the world.

In Iceland, Verne Global receives all of the power for its data center from hydro electric and geothermal sources. The facility was far enough away that it wasn't affected by the Eyjafjallajökull volcano in the spring of 2010.

The greening effort of data centers will continue to expand as usage and power demands continue to increase.

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