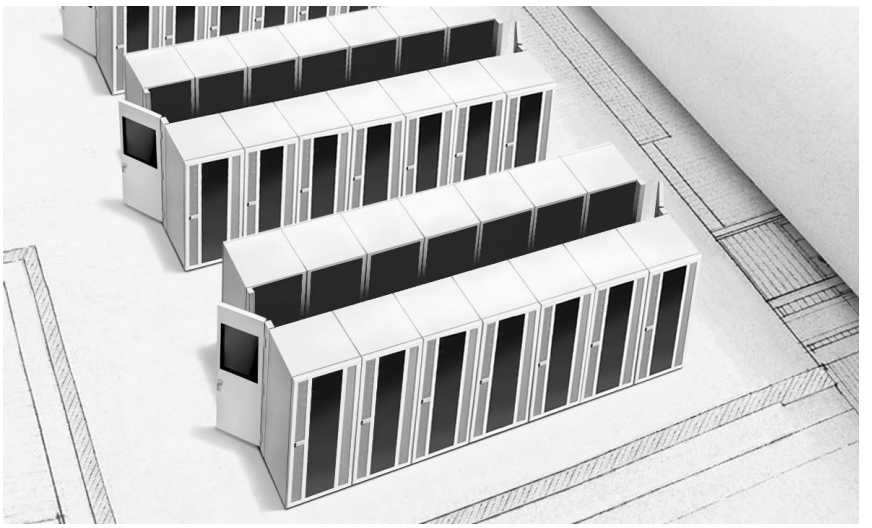
Energy-Efficient Data Center Upgrades

How Changes To Power, Cooling & Air Filtration Equipment Can Lead To Crucial Efficiency Gains

Data center operators are always looking for new ways to improve energy efficiency as a way to save money while still getting the best possible performance out of their equipment. While there are many ways to improve efficiency, including a complete redesign, gains can be achieved more simply by addressing three key areas: power equipment, air cleaning systems, and cooling systems. Improvements in these areas often require upgrading or entirely replacing equipment, but in some cases it only takes a few small changes to start seeing positive results.



Granular Changes To Power Equipment Can Add Up

When it comes to improving energy efficiency via your power equipment, the important thing to realize is that not all of the benefits are going to be direct. In fact, Brad Wilson, president at Geist, says that "most power distribution equipment is made to pass through the electricity, and therefore won't have much effect directly on efficiency." However, where you will see potential power loss and the need to make adjustments for efficiency gains is with power distribution in relation to transformers and UPSes (uninterruptible power supplies). "Transformers can be designed to decrease harmonics and associated heat losses," says Wilson. "UPS technology can be evaluated to determine rightsizing and technology for the environment and duty expectations."

Again, Wilson points out that just replacing power distribution equipment probably won't lead to significant efficiency gains, but if you dig a bit deeper and start looking at adding "more granular power monitoring at the circuit and server level," then you can start to "understand actual compute loads, server efficiencies, and circuit power consumption." Once you get that baseline and start understanding how your equipment is operating, you can start tweaking components to try to improve efficiency and performance. "By maximizing the power use per cabinet or server through tools such as virtualized servers, data centers can maximize the usage of the expensive power infrastructure, increase densities, and lower the effect of stranded power," Wilson says.

PDUs (power distribution units) present another situation where you can't simply buy a new system and immediately see efficiency gains. Instead, you have to look at "the quality of internal connections and general construction," which can "affect heat losses within the terminations and connections in the PDU," Wilson says. In this instance, you are actually looking at the internal components and connections inside of a PDU system to make sure that everything is operating at the highest level. It's a perfect example of how knowing more about your equipment from a monitoring and management perspective can lead to seemingly small changes that add up.

"The PDU construction should be evaluated to ensure that the connections are reliable and are not generating excess heat, which is a power loss," says Wilson. "Often, the PDU is used as a point-of-use monitoring device that can point out inefficiencies within the IT equipment in utilization of the circuits or the servers. The data gathered from a smart PDU, coupled with a data consolidation tool such as a DCIM [data center infrastructure management] system, can yield valuable insights into power use, distribution effectiveness, and stranded power. One often overlooked inefficiency in data centers is stranded power or designing and allocating power per zone or cabinet, but not utilizing that infrastructure to the fullest extent once equipment is deployed."

How Air Quality Can Impact Energy Efficiency

"Today there are high efficiency filter technologies available with pressure drops that are far lower than high-efficiency passive filters. This technology can sometimes allow HVAC system designers to use smaller fans. The filter technology offers dust loading capacities and the ability to remove ultrafine particles (those smaller than 0.3 microns) and black carbon from automobile exhaust. They operate at low static pressures for longer intervals."

- Robert F. Goodfellow, CAFS, Vice President of Marketing, Dynamic Air Quality Solutions

One area you might not immediately think of when talking about energy efficiency is air quality. You hear a lot about how important it is to maintain hot-aisle/cold-aisle arrangements and similar approaches, but the actual quality of the air is also crucial to making sure your systems are operating correctly. Robert F. Goodfellow, CAFS, vice president of marketing with Dynamic Air Quality Solutions, says that "historically, filter efficiency has been at odds with energy efficiency," but adds that "this is no longer the case." In the past, with mechanical filters, "static pressure resistance increased as filter efficiency increased, which resulted in a loss of efficiency," he says. In other words, the more efficient the air filter, the higher the drop in pressure and the higher the brake horsepower required to operate the fans that deliver adequate airflow to the data center.

Today, air filter manufacturers are working to create high efficiency filter technologies with much lower pressure drops than the filters that came before them, which means that you can properly filter the air without negatively impacting efficiency, or at least minimizing the impact. "This technology can sometimes allow HVAC system designers to use smaller fans," says Goodfellow. "The filter technology offers dust loading capacities and the ability to remove ultrafine particles (those smaller than 0.3 microns) and black carbon from automobile exhaust. They operate at low static pressures for longer intervals. In the case of the Dynamic V8 Air Cleaning System, filter service life is measured in years instead of months which translates to additional operational savings to boost PUE."

Potential Cooling Equipment Upgrades To Consider

When it comes to improving energy efficiency, cooling equipment is often the first place you look, and often before you would consider air quality or power equipment. And perhaps that's why there are so many approaches you can take to improving efficiency while still cooling your equipment to the proper temperature. Goodfellow points out that while there are many ways to upgrade your cooling equipment with efficiency in mind, the "energy cost savings and operational cost savings can depend on the type of equipment, geography and climate."

For example, if you live in an area with a cooler climate, you might be able to use outdoor air for cooling your data center. However, Goodfellow explains, while this "allows facilities to conserve cooling energy, the use of more outdoor air can increase the potential exposure to hazardous airborne contaminants." This can occur gradually, such as through a buildup of ultrafine air particles from car exhaust and other pollution, or as a result of "one single large scale event, such as a forest fire," Goodfellow says.

This is where air filtration would come into play. "There are air cleaning systems available today that can effectively clean incoming ventilation air and recirculated indoor air and can do so without the large energy penalty," Goodfellow says. And that's perhaps the most important thing to remember about energy efficiency. There isn't necessarily going to be one silver bullet that solves all of your problems. Rather, you may have to take multiple approaches complete with dozens of granular adjustments in order to receive the efficiency gains you desire. P

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