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2014's FRESH NEW LOOK!

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GREENING THE DATA CENTER

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WHAT'S INSIDE

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The Airflow Containment Thermal Revolution

The path to energy efficiency in data centers is increasingly becoming regulated by state and federal governments. Airflow containment is at the top of the list.

Airflow containment — the ability to isolate, redirect, and recycle hot exhaust air has revolutionized the idea of "free cooling" within the data center. The energy saving benefits are so convincing, new laws are being passed requiring the use of airflow containment to comply with strict energy efficiency guidelines for data centers.

A typical data center facility consumes up to 50% more energy than a standard office space, according to the U.S. Environmental Protection Agency (EPA). Also, according to EPA's Energy Star program, energy consumption in data centers is expected to grow at a rate of almost 10% annually through 2020. Add the increasing popularity of cloud computing and heavy virtualization, and that rate can go much higher.

Simply put, implementing defined measures to mitigate energy consumption in the data center has never been more vital to businesses' bottom line and to the environment.

By Raissa Carey

Raissa Carey is the eContent Specialist at Chatsworth Products (CPI), a global manufacturer of products and service solutions that optimize, store, and secure technology equipment. Carey has more than 15 years of experience as a writer and editor for various industries, having worked for quality management, financial services, and business intelligence publications in the United States and internationally.

RAISING THE BAR FOR ENERGY EFFICIENCY

With a long history of support for green energy, California's ongoing efforts to increase renewable electricity production have made it a recognized leader in the green energy field.

It wasn't surprising that California was the first U.S. state to implement energy efficiency requirements specifically for data centers and computer rooms across the state in the most recent version of Building Energy Efficiency Standards, overseen by the California Energy Commission. Most commonly known as Title 24 (as in Title 24 from the California Code of Regulations), the new bill is intended to regulate the amount of energy being used in every building in the state. It went into effect July 1.

With the new updates to Title 24, the Golden State is targeting zero net energy (ZNE) use in commercial buildings by 2030. This

means the total amount of annual energy used by the building should be roughly the same as the amount of renewable energy created on the site. Most ZNE buildings still get half or more of their energy from conventional grid power, although some are completely independent.

In a ZNE building, energy is usually generated on-site through a combination of energy-producing technologies such as solar and wind, while reducing the overall use of energy with highly efficient HVAC, lighting systems, and other technologies. One of the requirements in the Title 24 update is that newly constructed, high-density data centers should include some form of airflow containment in their infrastructure.

To get to the point of drafting the new California building regulations, the state's energy agency looked at what was happening in the industry across the country and in Europe, according to Joe Loyer, a mechanical engineer at the California Energy Commission.

"For the most part, we were very happy to find that most of the stakeholders had very few concerns regarding our proposed standards. Data centers are trending towards energy efficiency not to be green, but to save money. Case in point: containment. Done with thought and planning it absolutely works," Loyer says. "The question is not whether containment saves energy and money, but how much money it saves and how soon the return of investment can be realized," he adds.

"If they really want to be green, data center designers need to beat the 2013 Standards design by 15%," says Loyer.

According to the California Energy Commission, since 1978, these energy-efficiency standards have saved Californians more than $66 billion in electricity and natural gas costs.

"Reducing data center energy consumption through the use of containment or ducted exhausts reduces the amount cooling capacity. The reduction of greenhouse gases from less electrical power generation will benefit everyone. California once again leads the nation in helping protect the environment, and these efficiencies will likely be embraced globally," says Dennis VanLith, director of global product management for Chatsworth Products.

The White House is also taking steps to make federal data centers more energy efficient. In March, the U.S. House of Representatives approved the Energy Efficiency Improvement Act, a bipartisan bill that requires commercial and federal facilities — particularly data centers — to operate more efficiently.

The proposed bill requires federal agencies to seek and implement solutions to improve the energy efficiency of data centers by, "requiring DOE to update a 2007 report on data center energy efficiency and maintain a data center energy practitioner certification program. DOE would also establish an open data initiative to help share best practices and support further innovation and develop a metric that measures data center energy efficiency."

Federal data centers alone consume about 10% of all U.S. data center energy use, according to the Green Grid Association. If it becomes law, every federal data center will have to develop and implement proven energy-efficient and energy-reduction strategies.

WHY CONTAINMENT MATTERS

Having worked many years in the industry, Ian Seaton, CPI's global technology consultant, recently gave Upsite Technologies a brief analysis on the "future of data center airflow management."

"… The pace of adopting best practices in airflow management will increase, and I suspect the bar on defining best practices will be raised as well. This intensity will be driven by several factors. As we see a trend of data center consolidation, we will see a higher percentage of data center space managed by specialized experts who understand the economic value of effective airflow management, as well as how to execute it. In addition, we can expect a legislative impetus as more states and municipalities adopt the requirements of the latest ASHRAE 90.1.

For example, California has been an early adopter and its Title 24 Energy Code now mandates airflow containment barriers in data centers. Finally, The Green Grid is developing tools to translate airflow management improvements into energy use savings. As it becomes easier for data center managers to demonstrate positive ROI, I suspect that will stimulate more activity in both new designs, as well as upgrading existing critical facilities."

Properly managing airflow in the data center is not a new concept in the industry, but it is a clear solution with proven cost benefits. When air recirculates and bypasses freely in the facility, server inlet temperatures change inadvertently, which not only damages equipment overtime, but it also takes away from cooling capacity. The way to mitigate this is to fully separate supply and return air with hot aisle, cold aisle, or cabinet-level containment.

The decision between hot aisle containment, cold aisle containment, or cabinet-level containment depends on variables such as facility architecture, business goals, implementation constraints, etc.

COLD AISLE VS. HOT AISLE CONTAINMENT

Cold aisle containment (CAC) isolates a room's cold air supply and confines it to an entirely closed off area targeted at cooling IT equipment instead of the room. In a typical CAC design, the fronts of cabinets face each other, and aisle containment doors are used at each end of the aisle to keep air from leaking. Ceiling panels across the cabinet rows create a complete air segregation system. This keeps the equipment

cool but the room outside of the CAC is very warm.

A CAC solution is usually the choice in retrofit applications, especially in situations where significant overhead obstacles exist, such as power and data cable distribution pathways and lighting.

On the other hand, in a hot aisle containment (HAC) system, hot exhaust air from IT equipment is isolated in the hot aisle and directed back to the CRAC/CRAH through a vertical exhaust duct that extends to the room's drop ceiling. By keeping the hot exhaust air completely separated from the cold air, cooling units do not have to work to regulate supply temperature increases from high-density switches and servers.

There are two typical HAC designs available: cabinet supported HAC, which includes doors at each end of the aisle and a vertical exhaust duct; or frame supported HAC, which uses an independent frame that can stand on its own, allowing pre-configured cabinets with varying heights to be easily added and removed.

To get the most of a data center aisle containment solution, it is important to also conduct a pre-installation site survey to identify important factors such as airflow delivery, overhead structures, uneven areas in the floor, and other characteristics unique to each installation. Placing well-engineered accessories such as grommets and filler panels that block any air leakage from rack units and cable openings are also crucial.

BECOMING OFFICIALLY GREEN

An effective thermal management plan not only saves data centers money in energy efficiency, but also helps them earn the internationally recognized Leadership in Energy and Environmental Design (LEED®) certification.

Developed by the U.S. Green Building Council (USGBC), LEED promotes sustainable design and construction practices to ensure measurable energy efficiencies are achieved, as well as huge money savings in the long run. With a LEED certification, your data center is automatically recognized as environmentally friendly with a proven low-cost operating structure.

The energy efficiency gained and measured through the implementation of a successful airflow containment strategy can help companies seeking a LEED certification earn credits toward their desired certification level.

From the 110 possible credits, here's the account of each category:

- Certified: 40-49 points earned
- Silver: 50-59 points earned
- Gold: 60-79 points earned
- Platinum: 80+ points earned

POSITIVELY POPULAR

With so many proven cost-savings, it is easy to assume airflow containment will gain a lot of traction in the industry, especially as the new updates to California's Title 24 are enforced and sought in other parts of the country.

In fact, according to EPA's Energy Star program, vendors and customers in other states, such as Ohio, North Carolina, South Carolina, and Wisconsin, have been showing interest in data center and IT equipment energy efficiency practices. The government-funded program has already included airflow containment in its guidelines for energy-saving and credit-earning opportunities in data centers.

As more endusers demand proven energy-efficient solutions for their data centers, decision makers will have to raise the bar in establishing best practices and strategies to help the industry achieve the common goal of saving energy and "going green."

If history is any guide, then airflow containment will be one of these strategies. ■

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