PLANNING GUIDE

Creating the Green Data Center

Simple Measures to Reduce Energy Consumption

ADC®

Introduction

Energy Awareness Driving Decisions in the DataCenter

The continued thirst for energy is a recurring story in news headlines every day.

Global warming forecasts rising temperatures, melting ice, and population dislocations due to accumulation of greenhouse gases in our atmosphere from use of carbon-based energy. There are strong arguments for and against the dire predictions of global warming, yet one fact is undeniable—over the past 10 to 20 years, the inhabitants of Earth are collectively consuming more energy at a faster rate than ever before.

No where is this more apparent than in the data center where power consumption has doubled in the past five years and is expected to rise at a steeper rate of 76% from 2005 to 2010. One culprit is steadily increasing power requirements for servers. For example, according to IDC (2006), the average small to medium size server required 150 W of power in 1996. These small to medium servers will require over 450 W by 2010. Of course, increased power requirements means increased heat to dissipate, driving another culprit for increased energy use in the data center—cooling. One survey of IT executives shows that 45% of data center energy consumption goes to chiller/cooling towers and computer room air conditioners (CRACs). According to IDC 2006, in the year 2000, for every $1 spent on new servers, 21 cents was spent on power and cooling.

By 2010, IDC predicts that every $1 spent on new servers will require 71 cents on power and cooling. This massive increase has led to the formation of industry consortiums such as The Green Grid℠ that are specifically focusing efforts on lowering power consumption in the data center.

For some businesses, increased energy costs are merely considered a cost of doing business. Yet there is a point at which these costs dampen profits and limit investment needed to grow and modernize a business. Worse are shortages of electricity occurring in pockets around North America that prohibit businesses from expanding data center operations to keep pace with their growing company.

There are many ways to promote conservation of electricity in the data center. For example, server virtualization allows multiple applications to run on individual servers, which means fewer servers to power and cool. In practice, a data center may be able to reduce the number of servers from 70 to 45, for example. Virtualization recognizes that a server gives off 100% of its heat if it is 20% or 90% in use. This dramatically reduces power and cooling costs across the data center.

Yet there are many other ways to reduce power and cooling costs in the data center—ways that are far simpler and less expensive to implement.

Airflow Management in Cabinets

New server platforms can support 800 to 1,000+ optical fiber terminations or 600-1000+ copper cable terminations per chassis. The prospect of crowding too many cables into vertical managers poses a problem for thermal management in cabinets. When air cannot properly circulate in the cabinet, data center fans are called upon to move more air and cooling units to lower air temperature—both of which consume additional, unnecessary electricity.

For years the IT industry has promoted the benefits of increased rack and cabinet density. Servers are smaller than ever and more can fit into the same space. The rationale has always been to make the best use of data center floor space. Yet today the balance is shifting. New servers are consuming more energy than ever before, causing data center and facilities managers to weigh spiking operating costs due to more energy usage against the capital cost of "wasted" space of lower density configuration in raised floor environments. Instead of just focusing on density, energy efficiency demands that data center and facilities mangers look at managed density.

Managed density recognizes that there really is a limit to the number of cable terminations and servers that can safely and economically be housed in cabinets. A prime issue is potential blocking of airflow caused by too many cables within the cabinet. One solution is to limit the number of servers and cable terminations in a cabinet, especially in copper racks where cable diameter is larger. Another is to employ basic cable management within the cabinet, such as securing cables along the entire length of vertical cable managers to open airflow. Similarly, integrated slack management systems locate and organize patch cords so that maximum space is available for flow of cool air into and out of the cabinet.

Using smaller diameter copper cable is another means to improve airflow within the cabinet. For many data centers, copper equipment terminations are still prevalent, especially with the ability to push 10Gb/s over Augmented Category 6 cabling. The choice of copper cabling can impact airflow because some cables have a much smaller outside diameter. For example, ADC's AirES technology provides superior conductor insulation that allows cable to exceed standards for electrical performance using smaller gauge copper and less insulating material. The result is cable with an average outside diameter that is 28 to 32 percent smaller than standard Category 6 or Category 6a cables. Less cable means reduced blockage in the cabinet, allowing air to flow more freely and do its important job of cooling equipment—which then uses less electricity.

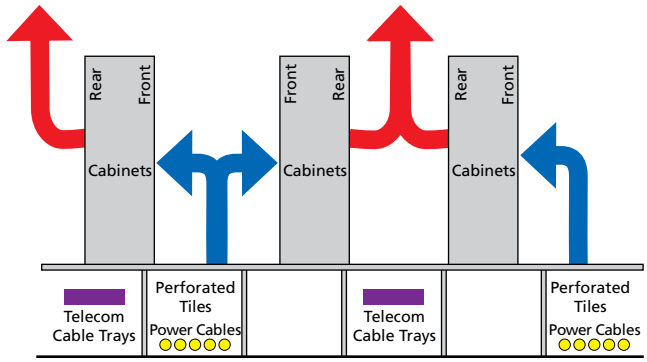
With proper cable management and smaller diameter cables, cable fill ratio for vertical cable guides of 60 percent supports higher density configurations without compromising airflow; higher server density is possible without inducing added electricity use for fans and cooling equipment.

Airflow Management in the Data Center

There are many simple solutions to improve overall airflow efficiency in the data center that can be implemented immediately, and without major changes in the design and layout of the data center. In general, unrestricted airflow requires less power for cooling efforts. **Each incremental improvement results in less energy to cool equipment—reducing costs and limiting output of greenhouse gases from the power company. These simple solutions include the following:**

- Plug unnecessary vents in raised floor perforated tiles.
- Plug other leakages in the raised floor by sealing cable cutouts, sealing the spaces between floors and walls, and replacing missing tiles.
- Reduce air leakage by using gaskets to fit floor tiles more securely onto floor frames
- Ensure that vented floor tiles are properly situated to reduce hot spots and wash cool air into equipment air intakes.
- Manage heat sources directly by situating small fans near the heat source of equipment.
- Use time of day lighting controls or motion sensors to dim the lights when no one is in the data center; lights use electricity and generate added heat, which requires added cooling.
- Reduce overall data center lighting requirements by using small, portable lights within each cabinet, which puts light where technicians need it.
- Turn off servers not in use.

There are also many avenues for improving data airflow that require more planning and execution. The most documented and discussed is the hot aisle/cold aisle configuration for cabinets. This design for the raised floor area effectively manages airflow and temperature by keeping hot aisles hot and the cold aisles cold. Aisles designated for cold air situate servers and other equipment in cabinets so that air inlet ports face the cold aisle. Similarly, hot air equipment outlets are situated in cabinets facing only into the hot aisle. Cool air for the data center is only pushed through perforated floor tiles into cold aisles; hot air from equipment exhausts into the hot aisle.



Designing hot aisle/cold aisle presents its own set of challenges, including the following:

- Ensuring that cool air supply flow is adequate for the space
- Sizing aisle widths for proper airflow
- Positioning equipment so hot air does not re-circulate back into equipment cool air inlets
- Adding or removing perforated floor tiles to match the air inlet requirements of servers and other active equipment.
- Accounting for aisle ends, ceiling height and above cabinet blockages in airflow calculations.

Another ready means to improve cooling is removing blockages under the raised floor. The basic cable management technique of establishing clearly defined cable routing paths with raceway or cable trays under the floor keeps cables organized, using less space and avoiding the tangled mess of cables that can restrict airflow. Moving optical fiber cables into overhead raceway as well as removing abandoned cable and other unnecessary objects from below the floor also improves airflow.

Dust and dirt are enemies of the data center. Dust has a way to clogging equipment air inlets and clinging to the inside of active equipment. All of this dust requires more airflow and more cooling dollars in the data center. There is probably an active program for cleaning above the raised floor. It is just as important to periodically clean below the raised floor to reduce dust and dirt in the air.

There are many other initiatives that can be implemented to improve airflow throughout the data center and reduce energy costs. These include the following:

- Move air conditioning units closer to heat sources.
- During cooler months and in the cool of the evening time, use fresh air instead of re-circulated air.
- Reduce hot spots by installing blanking panels to increase CRAC air return temperature.
- Consider using ducted returns.

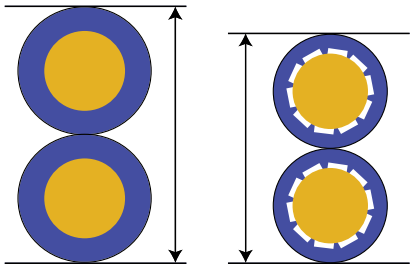
According to APC (2006), implementing the hot aisle/cold aisle configuration can reduce electrical power consumption by 5 to 12 percent. This same study showed that even simple measures such as proper location of perforated floor tiles can reduce power consumption by as much as 6 percent. By implementing even the smallest measures, power consumption can be drastically reduced.

Clearly defined cable routing paths keep cables organized, using less space and avoiding the tangled mess of cables that can restrict airflow.

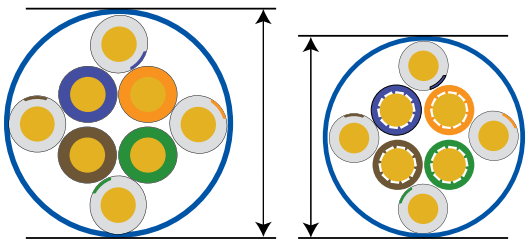
Moving optical fiber cables into overhead raceways, opens up airflow underneath floor panels

Selecting Green Cable

It was shown earlier that cable made with AirES conductor insulation is smaller in diameter and therefore contributes to improved airflow and reduced energy costs. Yet for the truly environmentally conscious individual, copper cable made with AirES technology offers another important benefit—less material is used for cable construction. By combining channels of air with traditional FEP insulation material, the net effect of AirES is superior electrical performance and smaller outside cable diameter. Yet the AirES cable is 28 to 32 percent smaller because there is simply less copper and FEP used in the cable manufacturing process. For every 1,000 feet of cable made with AirES conductor insulation, 1.45 fewer pounds of FEP insulation and 1.25 fewer pounds of copper are required. This may not make a difference today that can be verified. However, cable made with less insulation and copper will have less impact on the landfill for installation scrap and when the cable is abandoned. For recycled cable, less material requires less energy for the recycling process, too.



Smaller twisted pairs....



...Equals smaller cables

Raw Material Savings:

up to 1.25 lbs. of copper
1.45 lbs of FEP per
1000 ft. of Cat 6 cable

AirES Technology.
Air channels allow for a smaller diameter cable while also using less FEP insulation.

LEED® Certification and the Data Center

Leadership in Energy and Environ mental Design (LEED) was developed by the U.S. Green Building Council (USGBC), a non-profit organization composed of building industry leaders promoting development of facilities that are environmentally responsible, while also profitable and healthy places to live and work.

The Green Building Rating System™ is the nationally accepted benchmark for the design, construction, and operation of LEED certified buildings. The charter is as follows: to build and operate an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life for all stakeholders.

Energy efficiency is a major component toward LEED certification. LEED certification is much more than a stamp of approval. In general, LEED buildings offer building owners significant financial rewards, including:

- have lower operating costs
- are healthier for occupants
- conserve water and energy
- offer increased asset value
- demonstrate owner's commitment to community
- requirement for most new federal, state and municipal buildings
- qualify for tax and zoning allowances and other incentives

Building owners earn LEED certification by earning points for design and usage in the five key areas based upon the LEED rating system. It is important to note that projects (buildings) are certified, not products. In fact, today products and services do not earn LEED project points. LEED projects earn points during the certification process and then are awarded one of four certification levels.

While there is no direct correlation between earning LEED certification and product selection, certain product choices can prove critical to overall project certification. Products such as **AirES® cable, FiberGuide®, and RiserGuide™** - to name just a few - can greatly improve passive airflow, thereby improving overall energy efficiency, one of the key elements toward LEED certification.

ADC's subject matter expertise with infrastructure upgrades can result in major benefits to those managers often focusing on things seen as bigger ticket items than infrastructure.

But the savings and benefits cannot be denied. According to IBM, infrastructure upgrades can result in cooling cost savings of 15 to 40%. Data center engineers and designers can leverage ADC's product and design expertise to reap these types of immediate benefits, allowing them to focus on other areas critical to cost and energy savings, as well as pending site certification.

Conclusion

There are many ways to reduce cooling requirements for data centers. Improving cable management, stopping air leakages, removing cable dams under the floor, choosing smaller diameter cable to improve airflow are just a handful of the measures available to data center planners and managers.

LEED certification or any initiative that conserves energy and saves money makes sense from many angles, especially for the power hungry data center: improved work environment for people and equipment, corporate commitment to community and environment, improved operating costs from reducing energy consumption.

ADC supports green data centers by designing and manufacturing solutions for passive airflow improvement that reduce cooling—and power—requirements. A well planned infrastructure will make a tremendous difference and ADC can get you there today.

For more information contact ADC at 1-800-366-3891 or +1-952-938-8080 www.adc.com/truenet

CREATING THE GREEN DATA CENTER

Website: www.adc.com

From North America, Call Toll Free: 1-800-366-3891 • Outside of North America: +1-952-938-8080

Fax: +1-952-917-3237 • For a listing of ADC's global sales office locations, please refer to our website.

ADC Telecommunications, Inc., P.O. Box 1101, Minneapolis, Minnesota USA 55440-1101

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