

The Green Data Center

Written by Andrew T. Flourney

With the prevalence of “Going Green”, it was only a matter of time before we took a look at data centers. Data centers consume an enormous amount of energy and with continually rising energy costs and increased environmental concern, data center managers and the designers of new data centers will need to look into more ways to cut down on the power consumed and the materials deployed. What are the concerns? Are we saying that data centers should install solar panels on their roofs, windmills in the parking lot next door, or use recyclable materials on their critical data floor space? These may be options in the future; however, the immediate, achievable goal should be focused on increasing the efficiency of the equipment and deploying energy-efficient processes.



Increasing Equipment Efficiency

What are some methods for increasing the efficiency of a data center? For an existing facility, improving airflow is a simple, yet highly effective method. In a data center environment, air can be “lost”. By “lost”, the air is not directed to where it is needed, but has found another path. We can improve the airflow by utilizing a method of sealing around penetrations in the data center. Some examples include sealing around conduits that penetrate the walls of the data center, placing perforated tiles only where needed, and several other methods.



Mapping the location of the power on the floor is another critical step in being able to determine ways to save power. This can be done with monitoring programs, but to truly understand the utilization of your data center power, a more sophisticated system, such as, air flow analysis programs, heat tracing procedures, battery monitoring, branch circuit monitoring, etc. may be necessary. Once a monitoring program is in place, improvements in the power distribution of a facility can be determined. For instance, an abundant number of lights may be installed that are running in a facility 24 hours, 7 days a week. Motion sensors may be installed that can control the lighting at certain times of the day.

Consolidation of applications on servers is another method to achieve a reduction in energy consumption. Additionally, turning off servers that are only moderately utilized can significantly reduce energy consumption.

Increasing the efficiency of equipment in the data center is another critical factor in designing Green data centers. Efficient methods of cooling are determined by the systems used to provide cooling and expend heat. For example, a water-cooled chiller plant with cooling towers for heat dissipation is significantly more efficient than an air-cooled chiller system. A much greater amount of heat can be transferred by using water as compared to air.

Uninterruptible Power Supplies that have a high-efficiency are available and while the upfront cost of these units compared to traditional equipment is more expensive, significant cost savings will be realized in subsequent utility bills. Traditional data center environments that utilize large static UPS systems with battery back-up are beginning to look at other solutions for "clean" power. A solution based on kinetic/fly-wheel technology has been around for many years and is starting to resurface. The fly-wheel unit spins a large mass and is continually available in the event of a power failure. It continues to spin and provides power to the facility through the energy that is generated from the inertial rotation of the mass. This solution takes the place of traditional UPS systems and batteries. No longer is it necessary to change from AC to DC and back to AC, which has significant energy losses associated with it. With these systems, replaceable batteries are not needed, thereby making it environmentally friendly.



Early 20th century fly-wheel generator



21st century fly-wheel generators

Deploying Energy-efficient Processes

How do we ensure that our facility is operating as designed? Commissioning. Commissioning is the process of ensuring that a building's complex array of systems is designed, installed and tested to perform according to the design intent and the building owner's operational needs. For Green data centers, it becomes more important that the equipment that is installed in the data center operates as designed and in optimum configuration. If equipment is not performing at its peak design conditions, then efficiency is reduced and energy is wasted.

Continual commissioning and monitoring is critical to properly maintain a data center. A data center manager must know exactly how the data center is running to determine when equipment must be replaced or serviced. A piece of equipment may run several years without additional servicing, but may not be running at its highest efficiency. Creating maintenance programs allows data center managers to map when pieces of equipment should be serviced. This can prevent a possible failure situation, which could cause down time in the data center.

Summary

Data centers will continue to evolve during the drive to consume energy more efficiently. To realize the benefits of a Green data center, life cycle cost analyses should be performed and “Green” equipment and methods should be employed.

12/3/07



Cooling towers using steam for heat rejection.