IT'S NEVER BEEN DONE BEFORE

# Emerson Shows Data Centers How to Take the Heat Out of Energy Costs

Facing tight budgets, carbon footprint concerns, and high energy costs, chief information officers and information technology managers are looking for ways to save money, lower energy use, and squeeze more efficiency out of their power-hungry, heat-sensitive data centers. Emerson's Energy Logic strategies show them how to do it … by reducing excess heat load in the first place.

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Data centers in the United States alone soaked up about 61 billion kilowatt-hours (kWh), or $4.5 billion worth of electricity in 2006. If current energy usage trends continue, a U.S. Environmental Protection Agency predicts U.S. data centers will use more than 100 billion kWh by 2011, representing $7.4 billion in annual electricity costs and 2.5 percent of the nation's total electricity.

***It's Never Been Done Before.*** To help the industry tackle these challenges, Emerson has developed *Energy Logic*, the first-ever holistic approach to data center energy reduction, based on quantitative analysis, and with an emphasis on reducing excess heat load in the first place. Following Emerson's recommended actions can reduce a data center's energy consumption by at least 50 percent using existing technologies – and, in the process, help the data center industry globally save billions of dollars in energy costs.

To develop its recommendations, Emerson modeled energy consumption for a typical 5,000-square-foot data center. The company's engineers carefully analyzed energy-saving opportunities, quantified the savings of each action, and identified how energy reduction in some systems affects consumption in supporting systems.

The key insight that emerged from this analysis was that the best way to reduce energy consumption in a data center is to start with the IT equipment because savings at the IT equipment level "cascade" through the supporting infrastructure. For example, in Emerson's data center model, saving one watt at the server component level saved another 1.84 watts without doing anything else – a total saving of 2.84 watts.

Using this analysis, Emerson has identified the top 10 strategies for improving data center energy efficiency, starting with the IT equipment and progressing to the support infrastructure, including cooling systems.

Emerson's *Energy Logic* approach is a vendor-neutral roadmap. All technologies recommended in *Energy Logic* are available today – and many can be phased in as part of regular technology upgrades, minimizing capital expenditure. The Emerson model also


calculates ROI/payback periods for each of the 10 strategies to help organizations make better decisions regarding the most efficient technologies for a particular data center.

These strategies have the added benefit of alleviating the three most critical constraints faced by data center managers today: power, cooling, and space capacities. In the Emerson data center model, implementation of the top 10 Energy Logic strategies actually freed up two-thirds of valuable raised floor space, one-third of uninterruptible power supply capacity, and 40 percent of precision cooling capacity.

**Emerson's *Energy Logic* Top 10 Strategies**

Emerson's recommended 10 strategies to improve energy efficiency in a data center are:

**1. Low-Power Processor:** The typical Thermal Design Power (TDP) of processors in use today averages 91 Watts. Manufacturers have lower-voltage versions of their processors that consume on average 30 Watts less than standard processors – delivering the same performance as higher-power models. This can create a **10 percent reduction** in overall data center power consumption.

**2. High-Efficiency Power Supplies:** Use of best-in-class technologies for power supplies delivers efficiency of 90+ percent, reducing power draw within the data center by 124 kW or **11 percent** of the 1,127 kW total. Be aware that some power supplies perform better at partial loads than others, and these power supplies are preferred.

**3. Server Power Management:** Data centers are sized for peak conditions that may rarely exist. Without power management software, the idle power draw is 80 percent, but it's shaved to 45 percent as power management is enabled. This saves 86 kW, or **8 percent**, of the data center load.

**4. Blade Servers:** Blade servers consume about 10 percent less power than equivalent rack mount servers thanks to multiple servers sharing common power supplies, cooling fans and other components. In its analysis, Emerson saw a **1 percent reduction** in total energy consumption when 20 percent of rack-based servers were replaced with blade servers. While this saving may not be high, it is important because it enables high density architecture discussed in point 9 below.

**5. Server Virtualization:** As server technologies are optimized, virtualization is increasingly being deployed to increase server utilization and reduce the number of physical servers required. Virtualization provides an **8 percent reduction** in total data center power draw for a 5,000-square foot facility.

**6. Higher-Voltage AC Power Distribution:** In most U.S. data centers, the uninterruptible power supply (UPS) system delivers power to the servers at 208 volts. If the voltage can be raised to 240 volts, the power supplies in the servers will operate at a higher efficiency. **A reduction of up to 2 percent** in energy use can be achieved by using a higher-voltage AC power distribution.

**7. Cooling Best Practices:** Implementing best practices, such as sealing gaps in floors, using blanking panels in open spaces in racks, and avoiding mixing of hot and cold air, saves money. Computational fluid dynamics (CFD) can also be used to identify inefficiencies and optimize data center airflow. Cooling system efficiency is improved 5 percent simply by implementing best practices, reducing overall facility energy costs by **1 percent** with next to no investment in new technology.

**8. Variable-Capacity Cooling:** Newer technologies, such as digital scroll compressors and variable frequency drives in computer room air conditioners (CRACs), allow high efficiencies to be maintained at partial loads. In a chilled water-based air conditioning system, the use


of variable frequency drives provided an extra **savings of 4 percent** in data center power consumption.

**9. High-Density Supplemental Cooling:** Optimizing data center energy efficiency requires moving from traditional data center densities to an environment that can support much higher densities. This means shifting some of the cooling load from traditional CRAC units to supplemental cooling units, which can reduce cooling costs by 30 percent. In the Emerson analysis, 20 racks at 12 kW density per rack use high-density supplemental cooling, while the remaining 40 racks at 3.2 kW density are supported by the traditional room cooling system, resulting in a **6 percent reduction** in overall data center energy costs.

**10. Monitoring and Optimization:** Cooling control systems can monitor conditions across the data center and coordinate the activities of multiple units to prevent conflicts. In the Emerson analysis, an incremental **savings of 1 percent** was achieved as a result of system-level monitoring and control.

To complement its *Energy Logic* strategies, Emerson has also introduced an ***Energy Logic*** efficiency calculator that data center professionals can use to measure their facility's energy efficiency, helping them to benchmark performance vs. energy use. This efficiency calculator helps measure progress over time, prioritize the most productive actions, and report progress to management.