



Best Practices for Saving Energy in Data Centers

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The latest data centers can run energy bills up to 100 times those of typical office buildings. Efficiency measures can trim these costs substantially. Our study of 22 data centers has identified the following major ways to save energy.

- **Airflow Management** - The space-conditioning system is affected greatly by the path, temperature, and amount of cooling air delivered to the IT equipment and the separation of hot air removed from it. Best practices include eliminating mixing and recirculation of exhaust, and maximizing return-air temperatures by supplying optimally conditioned air directly to the loads.
- **Air Handler Systems** - The air handler fan is typically the second largest energy user in the mechanical system. Optimizing it for data center use, as opposed to relying on rules developed for office systems, can save energy.
- **Humidification** - Standard requirements (as defined by ASHRAE and equipment manufacturers) are broad and often too tight. A careful site specific design can avoid energy waste.
- **Chilled Water Plant Optimization** - High-efficiency chillers and variable-speed drives can garner large savings. Proper sizing can reduce initial costs dramatically.
- **IT Equipment Selection** - More efficient gear has become available recently, thereby reducing the need for mechanical infrastructure. For example, efficient power supplies, reduced power modes, and multi-core processors can all lower power requirements.
- **Electrical Infrastructure** - Backup power facilities themselves can use a large amount of power. Careful design, selection of efficient UPS systems, and on-site self-generation can reduce the usage. Shifting to a direct-current power infrastructure can produce significant savings.
- **Free Cooling** - Free cooling is the use of outside air or water cooling by cooling towers only. It allows one to turn off compressor systems and save energy. This option works during colder months or cold nights. In most climates, it is effective at least half the time.
- **Commissioning and Retrocommissioning** - An efficient data center requires not only reliable and efficient design, but proper construction and operation as well. Commissioning is a methodical and thorough process to ensure that systems are installed and operating correctly and efficiently. It can also be employed regularly to ensure proper operation. After all, data centers are hardly static environments. Workloads, requirements, equipment, and regulations all change. What was efficient when the data center was first built may be far from optimal later.

Maximizing energy efficiency while maintaining data center performance and reliability is not just a matter of implementing better technologies and operating procedures. It also requires effective systems integration throughout. That is, organizations must implement design-intent documentation, harmonize energy management with core business decision making, perform benchmarking, and build in-house expertise through training.

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