About this research note:

Operate & Optimize notes provide recommendations for effective and efficient IT practices that help improve the performance or reduce the cost of technologies already deployed in the enterprise.

Eight Ways to Save on Electricity Bills

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Executive Summary

The rising costs of electricity, rolling brownouts, and the ugly possibility of power surcharges from service providers all mean that enterprises will eventually be at risk of becoming “energy poor.” Given these economic and environmental factors, enterprises must plan to reduce electricity consumption in the data center and across the network. Enterprises can accomplish this by:

- Rightsizing the power infrastructure.
- Practicing intelligent energy conservation.
- Adopting energy-conscious purchasing habits.

Higher electricity costs are shrinking operational budgets. Target the power infrastructure of the data center as an area for cost savings.

Optimization Point

The average cost of commercial electricity is roughly 9¢ per kilowatt hour (kWh) in the United States. Some states pay more than others do, such as California, New York, and Hawaii. Canadian companies pay about 20% less than their American counterparts. Making matters worse is the capacity of a nation's electrical grid. The Great Blackout of 2003 proved that interconnected electrical networks are completely at the mercy of the energy provider with the weakest infrastructure, a reliability issue that has helped spur the increase in electricity prices.

Elsewhere, rising energy costs are prompting couriers such as UPS and DHL into adding a fuel surcharge to their shipping prices. Criticized as a thinly-veiled attempt to increase margins, a similar tactic will likely be adopted by ISPs and service providers should electricity costs rise even more (as they almost certainly will). Given this bleak outlook, enterprises must begin finding ways to reduce power consumption in the data center.

Stop the Bleeding Now

The number one culprit for inefficient power utilization is an oversized power infrastructure. While a certain level of scalability is always desired, an oversized power infrastructure in the server room can bleed money. Data centers built within the last 20 years require about 35 to 50 watts of power per square foot. As computing environments become more condensed, they need more electricity to operate.

- Today's small to mid-sized enterprises require 75 watts per square foot.
- Medium- to large-sized enterprises require 100 to 150 watts per square foot.
- A service provider requires 150 to 200 watts per square foot.
- Future server rooms are estimated to need 200 to 300 watts per square foot.

Usually, server rooms and data centers have a design life of about ten years. Although it's reasonable to build in some redundancy for future growth, the installed electrical capacity of many of these rooms is oversized. This means that their electrical capacity far exceeds usage. In fact, most enterprises use 30% or less of their total electrical capacity. And yet, reducing installed capacity can lower capital expense and other costs by up to 30%.

A study from APC revealed that electricity accounted for 19% of the TCO of a high-availability 2N data center. The numbers were based on a data center rated at 100kW, with a power density of 50 watts per square foot, and an average server rack power rating of 1,500 watts. By implementing the measures in the table below, APC concluded that TCO savings were possible for that data center:

Measure Taken in Data Center	Savings per Rack	% of TCO Saved
Installing power equipment with 2% higher efficiency.	$1,472	1.1%
Reducing electrical bill by $0.01 per kWh.	$3,100	2.4%
Getting rid of the raised server room floor.	$4,200	3.3%
Increasing cooling efficiency by 100%.	$5,500	4.3%
Rightsizing electrical capacity to actual needs.	$76,400	60.1%
Adopting low-consumption processor chips	$200 per server	Variable

Key Considerations

Hardware vendors are somewhat sensitive to electricity issues. For example, Sossaman is a low-powered Xeon chip that consumes only 31 watts. According to Intel, using low or idle utilization technology like Sossaman inside server platforms can deliver up to 24% power savings, which could mean $100,000 in savings annually for even a moderately sized enterprise with 500 servers. Elsewhere, HP's new Itanium chip claims twice the energy efficiency of previous systems and 50% more efficient than equivalent IBM systems.

Unfortunately, such announcements from chipmakers will have little impact on market demand in the near-term. For the majority of companies running less than 500 servers, the savings might only approach $200 per server annually. Saving $200 on annual server costs alone will not trigger IT managers to adjust their existing server refresh cycles, mainly because managers running data centers/server rooms are not usually mandated to save energy in data center operations.

However, it's estimated that electricity currently comprises 2% of the overall costs of an average N or N+1 data center. With the projected rise in North American electricity prices, that percentage will increase. Rather than wait for server and network equipment manufacturers to deliver more efficient designs, enterprises will need to adopt a number of practical power-saving initiatives to reduce energy costs.

Improvement & Optimization

A few simple conservation measures can have a tangible, positive impact on the data center's operational budget. Follow these steps for maximizing efficient power consumption without sacrificing server room performance.

1. **Create a conservative power plan.** Create a baseline by calculating the annual energy consumption for each network device – this task will be easier if an inventory of fixed assets has already been conducted. Most major network device vendors will report power consumption listings for their devices on their Web sites or on a data-plate on the device itself. For example, a typical router consumes 400 Watts of power each hour. Since the U.S. average cost of power is 9¢ per kWh, a router operating 24/7 will cost the enterprise $315.36 each year. Develop load estimates by totaling normal operating power specifications for equipment. Extrapolate these numbers to all of the devices running on the network to see total costs. Use this information to determine if the data center's power density is realistic or not.
2. **Get density right.** Traditional guidelines for data center power density may not be applicable for high-density environments with blade servers. Standard specifications such as only 40 to 80 watts per square foot will result in centers that can't quite support current IT infrastructure. Overestimating power density, on the other hand, will strain both capital budget and cooling capacity. APC's recent technical white paper, "Guidelines for Specification of Data Center Power Density," describes a new approach for estimating power density. This approach considers the power requirements for new and emerging IT equipment and provides guidance on cooling issues.
3. **If moving or redesigning, follow best practices.** It's also been suggested that building now for a possible tripling of electrical needs ten years from now is not the best approach for reducing maintenance costs. APC further cautions IT managers that an energy efficient server should exhibit the following qualities:
    - » Power infrastructure should be modular, allowing for growth as well as reduction.
    - » Components should be plug-and-go, eliminating wiring work on live circuits.
    - » Capable of operating in N, N+1, or 2N configurations without modification.
4. **See if servers automatically adjust.** Many servers possess a feature that automatically senses and adjusts voltage levels, usually between 100 and 240 volts. However, not every server has this feature, so administrators have to adjust the servers manually for low- or high-line power requirements. Check to see what the servers are set at. High-line power settings are best suited for larger computing environments, so adjust them to low if the data center's computing capacity is small.

- » IBM, HP, and Sun all offer power management packages for their latest generation of blade servers. These solutions slow down processors that are not being highly utilized in order to save energy.

5. **Think before buying PCs, hardware, and peripherals.** Consider a device's energy draw before buying. Adopt the habit of factoring power consumption into long-term operational cost and cost of ownership projections. Beware: inexpensive devices may end up being more expensive in the long run if they are not energy efficient.
   - » Flat panel displays and thin client devices are great energy-saving alternatives. Consider, for example, the fact that it costs one-twelfth as much to power a thin client appliance than a fully loaded PC.
   - » Minimize the number of network management workstations and consoles in use by maximizing the number of programs running on a single workstation, and limiting the number of consoles used to configure routers and switches. Be careful, however, as this tactic may cause productivity loss as users fight for the right machine to manage their systems, thereby negating savings.
6. **Buy ENERGY STAR-compliant devices.** The U.S. Department of Energy and the Environmental Protection Agency recommend ENERGY STAR-compliant devices. ENERGY STAR devices power down into "sleep mode" when not in use, consuming only 15% of the device's maximum power usage. This step alone can reduce power consumption by 50% overall.
   - » While ENERGY STAR doesn't cover traditional network devices, it is available for most network-connected peripherals.
   - » Use screensavers on PC monitors as well as energy-saving sleep mode.
7. **Be smart about cooling.** Another area in which to reduce costs is cooling. A server room operating at 100 watts per square foot is generating around 340,000 BTUs, most of which is coming from the back of equipment racks. Take advantage of airflow patterns within the room by arranging server racks and equipment cabinets to face each other front-to-front. This ensures a stream of cooler air always flows between the two rows of machinery. Also, be sure to factor in power costs that device heat dissipation adds to HVAC systems.
   - » Ensure that empty spaces in front of racks and cabinets are filled in with blank panels to stop hot air from the back reaching the cooler air out front.
8. **Simply turn it off.** This is the number one action that can conserve power. While certain network devices must remain on constantly, others may not require "always-on" operation. Gone are the days when leaving computers on 24/7 was healthier for its electronic components – this is a myth.
   - » Consider shutting off devices like monitors and network diagnostic equipment when not in use.

- If it can be tolerated, also consider scheduling off-hour blackout periods during which certain low demand equipment is powered down.
- Many network and server room devices provide remote power on/off capabilities, thus allowing these operations to be performed remotely and automatically.

Bottom Line

While reducing power consumption seems like a back burner issue, taking steps to conserve energy can easily translate into tens of thousands of reclaimed dollars per year. Be a good corporate citizen and put energy conservation into practice immediately.