CDW·G®

Implementing Green I.T.
Eleven Ways I.T. Can Lower Power Consumption,
Reduce Costs & Eliminate Waste

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Executive Summary

Implementing green technology is quickly rising to the top of every organization's agenda, and with good reason: It takes a tremendous amount of energy — and taxpayer dollars — to power data centers, networks and computers.

As budgets shrink and environmental concerns grow, local, state and federal IT leaders are under pressure to do more with less while also reducing waste and energy consumption. Fortunately, taking a more environmentally friendly approach to technology deployment will also help IT departments reach those goals.

Government agencies can simultaneously reduce their carbon footprint, become more energy efficient and save money by pursuing a green strategy that includes adopting common-sense best practices, improving the utilization of existing IT equipment, and as budgets or regular upgrade cycles allow, investing in new, innovative technologies.

While there's a lot of marketing hype surrounding implementing green technology, CDW·G's white paper moves beyond that by providing actionable tips from technology manufacturers themselves to help you reach your green goals and produce measurable results.

1. Power down PCs at night and enable power management features.

Many staff members simply don't shut off their computers. Power management tools and remote systems management software can help IT administrators to enforce a power-off policy, and either shut down, hibernate or put to sleep every idle computer. Sleep and hibernation modes can reduce energy consumption by 60 percent, according to the nonprofit Climate Savers Computing Initiative.

Those energy savings could save $15 to $20 a year per computer, says Avocent CTO Ben Grimes. Avocent's LANDesk Management Suite and tools like it allow IT administrators to remotely manage the power settings on every computer on the network, and automatically shut down, hibernate or suspend PCs at night.

The software allows IT staffers to customize wattage settings to specific groups of users and shows estimated power savings before they deploy policies. It also provides reports on the amount of power, kilowatt hours and dollars saved.

Lenovo offers LANDesk in its Lenovo desktop and notebook PCs, while Hewlett-Packard offers similar remote power management software called Verdiem Surveyor. The Verdiem product allows system administrators to centrally control power settings on desktops.

PC manufacturers also offer power management tools on individual PCs. Lenovo's Green Power Manager software allows individual users to configure hibernation and sleep settings. When power schemes meet green standards, a green leaf pops up on the screen. HP provides HP Power Manager on a range of its business desktops, allowing individual users to control when to suspend PCs, shut off monitors and spin down hard drives.

Individual users can manipulate a convenient slider bar interface to change power settings, predict annual cost, energy and carbon emissions reductions, and view historical savings. Similarly, Acer offers Acer ePower Management, allowing users to change their power settings, including adjusting processor speed and monitor brightness.

2. Upgrade to a newer, more efficient uninterruptible power supply (UPS).

Most new UPS systems maintain at least 97 percent efficiency, meaning only 3 percent of the incoming power is lost. Older UPS devices operate at 70 to 80 percent efficiency, meaning 20 to 30 percent of the power is leaked out as heat.

Purchasing new modular UPS systems, such as APC's Symmetra PX, can also save energy. A 500KW system, for example, can be made up of 20 25KW power modules. In the past, IT departments traditionally used two large UPS devices side by side for redundancy, with each UPS operating at 50 percent loads or even smaller if they expected future growth.

Nowadays, IT departments no longer need to purchase two large UPS systems for redundancy, says Bill Bockoven, APC's vice president of government sales. With modular UPS devices, if one module goes down, another can pick up the workload. The result: IT departments can just purchase one modular UPS, operate it at 90 percent load and still get the redundancy they need.

3. Prolong notebook battery life.

Like all rechargeable batteries, a notebook battery's ability to hold maximum capacity will decrease over time or with usage. Lithium-ion batteries used in notebook computers typically have a lifespan of 300 to 500 charge cycles.

After one year of usage or 300 charge cycles, a lithium-ion battery only holds up to about 80 percent of its original capacity. But there

Progress Report

Of IT organizations that are pursuing green IT initiatives, 90 percent are reporting favorable results and 39 percent are cutting annual energy IT costs by 1 percent or more.

Of organizations that have reduced energy costs by 1 percent or more:

- 62 percent buy computers with newer, low-power, low-wattage processors
- 52 percent buy Energy Star 4.0-qualifying devices
- 50 percent train their staff to shut down their computers
- 48 percent implement server consolidation and optimization
- 41 percent make full use of power management tools

Source: 2008 Energy Efficient IT Report, CDW Corp.

are ways to extend a notebook battery's life, which reduces the need to purchase additional batteries, and in turn saves on natural resources.

First, conserve battery power to reduce power consumption on your notebook by reducing screen brightness, removing peripherals and reducing processor speed, according to HP. Second, high temperatures accelerate the deterioration of lithium-ion cells, so keep your notebook away from prolonged exposure to heat, such as hot cars.

Also, remove the battery if the notebook is turned off and not plugged into an AC adapter for more than two weeks. Remove the battery if the notebook will be plugged into AC power continuously for more than two weeks.

Calibrating the battery is also important. When users operate the battery intermittently and then recharge without fully draining it, the amount of power available in one charge cycle is reduced or the battery meter can become inaccurate. There are four steps to calibrating a battery: First, disable power management in the Windows operating system and select "always on" in the power scheme. That prevents the notebook from going to sleep.

Second, connect the AC adapter to the notebook and charge the battery until the meter says it's at 100 percent. Third, remove the AC adapter and drain the battery until the notebook shuts off. And fourth, reconnect the AC adapter, charge the battery and then turn Windows power management back on.

And last, Lenovo Master Inventor Howard Locker recommends that you never leave your notebook constantly plugged in. "The battery will last longer if it charges/discharges. So you don't want it 100 percent charged all the time," he explains. "Once in a while, let the battery drain." But contrary to popular opinion, it does not have to drain completely the first time it's used.

4. Shift to networked laser printers and multifunction printers and copiers.

Mandating the use of networked laser printers (with few exceptions) will not only help save the environment (paper, ink, chemicals, plastics) but can also help reduce costs. To save more energy, consolidate standalone devices such as personal desktop printers, fax machines, scanners and copiers to multifunction printers or copiers.

Management of these systems is relatively simple and can often be performed by network administrators via a web browser. Taking this

measure will also reduce the number of devices that will eventually end up in a landfill.

Now that you've networked your printers and copiers, set these devices to print double-sided, which HP estimates can cut paper usage by 25 percent.

Many printer manufacturers offer a feature that requires staff to walk to a printer and punch in a security code before the job prints. This security feature is critical for finance and legal departments, who produce confidential documents. But it also provides a green benefit because it reduces the number pages that actually get printed, says Dick Sullivan, enterprise marketing manager at EMC.

Storage manufacturer EMC, which pursues green IT internally, discovered that many of its print jobs were stored on printers but were never actually printed. The feature eliminates waste because it makes staff members think twice about whether they need to print, Sullivan says, and whether they want to walk to pick it up.

Many major printer manufacturers have launched aggressive return and recycle programs for consumables. For example, Brother offers postage-paid print labels online; Epson provides postage-paid recycled containers that can hold up to 30 laser toner cartridges; and Lexmark converts its recycled cartridges into a wood-like product called eLumber through a partnership with recycler Close the Loop. The two companies donate some of that lumber to Habitat for Humanity.

HP's ink-jet cartridge recycling process uses post-consumer recycled plastics in the production of new cartridges. Thus far, more than 200 million cartridges have been manufactured with this new engineering process, which uses more than 5 million pounds of recycled plastics per year.

EPA Updates Energy Star Requirements

The Environmental Protection Agency has updated its Energy Star specification for computers. Energy Star 5.0, which takes effect in July 2009, toughens up energy-efficiency requirements, including increasing power supply efficiency from 80 percent to 85 percent.

Xerox offers a line of Phaser MFP printers that use solid-ink technology instead of powdered toner. The printer creates color images by heating ink sticks and applying the colors to a drum inside the printer, which then transfers the image onto the page. It's safe, toxin-free and recyclable.

Solid-ink printing produces 90 percent less waste than laser printing, with only one consumable item, compared with the multiple consumables used by color laser printers, explains Donna Covannon, vice president of market development at Xerox. After 192,000 prints, a color laser produces about 450 pounds of waste; the solid-ink printer produces only 23 pounds.

5. Refresh with more energy-efficient computers and monitors.

When it's time to refresh equipment, purchase desktops, notebooks and monitors that meet stringent government energy-efficiency standards, such as Energy Star or EPEAT (Electronic Product Environmental Assessment Tool).

This is particularly important to federal agencies, as the U.S. government requires that 95 percent of all computers purchased for it must meet EPEAT standards. Additionally, more and more states, such as California and Massachusetts, are adopting similar measures.

Numerous computers are made with more efficient components, such as processors, power supplies and variable speed fans. On most notebooks, LED screens take up 30 percent less power than regular LCD screens.

Intel offers multicore processors that deliver increased performance, but at fewer watts. The chipmaker has shrunk its chip manufacturing process from 65 nanometers to 45 nanometers, which lowers power consumption because it uses smaller transistors.

Intel has also built power-saving features into its processors, says Ronak Singhal, senior principal engineer at Intel. Intel's processors feature Enhanced Intel SpeedStep, which allows systems to dynamically adjust processor voltage and core frequency if very few applications are running. That can result in decreased power consumption.

Intel's new Core i7 processors also offer Turbo Boost technology, which uses innovative "power gate transistors" to completely turn off frequency and voltage to cores. For example, if a quad-core computer only needs one core to run applications at the moment, it shuts off the others while boosting the frequency of one core to finish the job.

Core i7 processors are available for desktop systems now, with workstation and server systems available in the 2009 first quarter. A mainstream mobile processor should ship during the second half of 2009.

6. Consider adopting thin client computers.

Thin clients consume just 6.6 watts of energy, compared to desktops that can consume as much as 150 watts. Thin clients do require server power, but each thin-client user takes up only 8 to 10 watts on the server.

Smaller than desktops or notebooks, thin clients also require less raw materials to build and typically have a long lifespan of seven to eight years, which lessens their environmental impact, according to Wyse Chief Marketing Officer Jeff McNaught. In addition, thin clients don't need fans, make no noise and generate less heat, so it has no impact on office temperatures, and therefore, air-conditioning costs are lower.

Paper Is Ubiquitous.

The average office worker uses 10,000 sheets of paper per year, according to the Federal Network for Sustainability. If green's your thing, "printing on recycled paper, reusing it and recycling it is a good place to start," recommends Doug Washburn, infrastructure and operations analyst at Forrester Research.

The Environmental Protection Agency estimates that a ton of paper made from recycled fibers instead of virgin wood conserves 17 to 31 trees, 7,000 gallons of water and 4,000 kilowatts of electricity. "The federal government is now required to purchase paper with 30 percent [post-consumer recycled] fibers," Washburn says.

7. Consolidate servers, storage and even communications networks.

"Consolidate everything including applications, which are often overlooked," says EMC's Sullivan. "Look at overlaps and redundancies. In the military and government, there are a lot of changes that happen, and over time the number of applications become redundant as organizations change and gain new responsibilities."

SERVERS: When it's time to retire servers, replace the older, single-processor servers with new servers powered by more energy-efficient dual-core and quad-core processors. The multi-core processors pack more power, while reducing energy consumption by more than half.

For example, the Intel Xeon L5420 processor, a 2.5GHz quad-core processor, uses only 50 watts — that's 12.5 watts per core. These more powerful, energy-efficient systems, coupled with server virtualization to bolster utilization, will free up data center space and reduce power and cooling needs.

Servers today typically offer power management and cooling features including fans that speed up or slow down as needed, as well as more-efficient power supplies. Blade servers are more efficient than regular rack servers because blades share a single chassis, as well as power and cooling.

IBM's servers, for example, offer several energy-efficient features including solid state drives, explains Alex Yost, VP of IBM's BladeCenter. A regular hard drive with its spinning disks uses 10 to 15 watts, while solid state drives use just 1 watt. IBM's Calibrated Vectored Cooling is an architecture that optimizes cool airflow by directing cool air only to the parts of the chassis that need it. IBM servers also offer the ability to cap the amount of energy each server consumes.

HP also offers energy-efficiency and power management features in its ProLiant rack and blade servers, including HP Dynamic Power Capping. Capping power to servers allows IT administrators to more precisely use the available energy in a data center, "reclaim" energy capacity and save millions of dollars, says Mark Linesch, vice president of marketing for HP Insight software.

Here's how the concept works: First, IT administrators can measure each server's energy usage with HP's Insight Control software.

The energy used during the peak loads could be far lower than the amount of energy the server's faceplate or technical specs say it will use. Using HP Dynamic Power Capping, IT staffers can cap a server or a group of servers' energy at peak usage instead of the faceplate specification.

With more energy at its disposal, an IT department can fit up to three times more servers in the existing IT facility's power envelope without pulling new circuits. This alleviates costly power upgrades or the need to build new data centers, which saves millions in energy and capital expenditures and increases the life of existing data centers. "It's like building a six-room house and you're using only four of the rooms. You realize you can accommodate more people in the house," Linesch explains.

STORAGE: Use data deduplication technology, which deletes multiple copies of the same file, keeping one copy that staff can access. For example, if a PowerPoint file is sent to 10 coworkers, the technology during the daily backup process looks for duplicate copies and only saves one copy. Those 10 people can still access the PowerPoint file and think they have their own copy, but it's really a shared copy.

Decisions, Decisions: Power Off, Hibernate or Sleep?

While configuring power settings, consider eliminating screen savers, which waste energy, says Howard Locker, Lenovo Master Inventor. Desktops typically use 60 to 80 watts during normal use and 10 watts when idling. Notebooks use 10 to 30 watts under normal use, and 6 watts while idling. In hibernation mode, computers use zero watts, while computers in sleep mode use about 0.2 watts.

There is a debate over which is more efficient. Going into and out of hibernation mode does consume considerable energy. And some argue that completely shutting down the computer hurts productivity because the boot up time in the morning takes a few minutes. Locker's recommendation: hibernate if you are gone for two or three days. Put it to sleep if it's just overnight.

The Right Technology. Right Away.®

If one user makes a small change to the file, the technology is smart enough to save just the incremental change. The result is less data being stored and faster overnight backups, which saves energy, explains EMC's Sullivan.

EMC offers deduplication in its Centera archiving products, as well as its Avamar products for VMware virtualization environments. Symantec also offers deduplication technology in its NetBackup software.

To further save energy, organizations should use a tiered storage approach where the most important or frequently-used data is stored in the first tier. Move nonessential or dormant data from primary storage to secondary storage using lower-cost storage devices, and then create another storage tier for archives.

Secondary storage devices save energy because they typically have slower-spinning disks and fewer high-availability features. IT organizations have a choice between disk and tape for archiving. Tape is the best option for long-term data retention because once data is archived to tape it uses no energy, according to the Storage Networking Industry Association (SNIA).

Besides deduplication and tiered storage, Sullivan suggests using RAID 5 data storage configurations instead of RAID 1. That's because RAID 1 mirroring creates a complete duplicate set of data, requiring a doubling of disk drives and a doubling of power consumption. RAID 5 distributes the data across disks, and if one drive in the array fails, parity information on the remaining drives helps reconstruct the missing data. RAID 5 requires just one spare drive, which helps save energy, according to the SNIA.

NETWORK: As IT organizations virtualize servers and move applications to virtual machines, Cisco has introduced new networking technology to allow IT administrators to easily migrate those applications' network and server policies.

Cisco's new Nexus 1000V software, which will be delivered as a component of VMware ESX 4.0 later this year, sits on top of VMware's hypervisor to easily migrate policies such as quality of service, access control lists and virtual LANs, says Steve Picot, federal area manager for data center solutions at Cisco.

Cisco is touting the concept of a unified network, Fibre Channel over Ethernet, which merges Ethernet and Fibre Channel connections. Traditionally, a server may have up to eight network connections, including two Ethernet connections for network connectivity and primary and backup Fibre Channel connections to a storage area network.

The server is swamped with network cables and network interface cards. The goal of a unified network is to reduce the spaghetti of interfaces and cables down to one, which can result in significant power savings. Instead of eight interfaces that would use 20 to 25 watts each, the unified network would use just one interface. Cisco has released the Nexus 5000 Series 10 Gigabit Ethernet switch to help IT organizations build a unified network.

A more traditional, converged network — one that combines voice, video and data traffic — helps IT administrators reduce energy and maintenance costs because they are only operating and managing one system. Running an IP phone over Power-over-Ethernet uses less energy than a regular phone that's plugged into an electrical outlet.

Pursuing Green Throughout the IT Product Lifecycle

Green IT is the practice of using natural resources efficiently and minimizing environmental impact from IT procurement to disposal.

As part of a green strategy, IT organizations should assess which tech manufacturers have taken an environmentally conscious approach in their product design and are working to reduce their carbon footprint in their manufacturing processes.

For example, Lenovo has developed new energy-efficient LCD monitors that reduce the number of lamps from four to two. Xerox, for its part, has developed green printers that use solid ink, which produce less waste because IT administrators no longer have to dispose of toner cartridges.

Hewlett-Packard's DeskJet D2545 printer relies heavily on recycled materials, notes Michelle Price, manager of worldwide environmental strategic marketing at HP. Recycled plastics account for 83 percent of the printer's total plastic weight, and it uses ink cartridges molded from recycled plastic resins. The printer is also Energy Star-certified and comes in 100 percent recyclable packaging.

Some tech manufacturers are trying to make their packaging 100 percent recyclable. Acer, for example, is reducing its use of plastic foam. Acer's Aspire Netbooks ship primarily in cardboard packaging.

This traditional, converged network also allows government agencies to pursue the next green best practice on the list.

8. Reduce travel with video conferencing and unified communications.

The government has been a leader in teleworking, allowing staffers to work from home or in telework centers, reducing travel and helping to reduce carbon emissions. Deploying unified communications aids in teleworking and the overall green effort because it allows staff to stay in contact, collaborate and be productive.

Unified communications technology allows staff to hold video and audio conferences, instant message and make and retrieve office phone calls using their computers. High-end video conferencing, such as Cisco's TelePresence solutions, allows government leaders and staffers from all over the country — and the world — to hold meetings without having to travel.

Since 2006, Cisco says it's deployed TelePresence in 135 cities worldwide, and the company estimates that it has held almost 224,000 meetings using the technology. Of that total, staff members avoided travel in 43,000 of those meetings.

As a result, Cisco's use of TelePresence has saved 92 metric tons of emissions, or the equivalent of getting 21,122 cars off the road, says David Rubal, of federal unified communications at Cisco. Cisco's WebEx conference tools allow staff to hold web and audio conferences and to share documents, calendars and databases.

9. Raise the temperature in the data center.

Consider increasing the temperature to cut costs. Traditionally, data centers are cold because evidence suggests that hardware will run better when they're cooler. But making a data center too cold results in a big energy bill. The American Society of Heating, Refrigerating and Air-conditioning Engineers Inc. (ASHRAE), working closely with IT equipment manufacturers, has acknowledged that data center equipment can withstand higher temperatures and wider humidity ranges.

Previously, in 2004, ASHRAE recommended an environmental range of 68 to 77 degrees with relative humidity between 40 and 55 percent. In 2008, the organization widened the temperature range to 64.4 to 80.6 degrees and the relative humidity range to 35 percent to 60 percent.

Most data centers operate at 65 to 70 degrees, while some go as low as 60 degrees as a safety net against emergencies such as failure of the cooling systems. The strategy is to make the data center as warm as possible, but within reason and without putting equipment in jeopardy of overheating, says Bill Kosik, HP's energy and sustainability director.

Any rise in temperature does reduce the response time in case an emergency does occur. But a typical rule of thumb is for every one to two degrees you increase your set point temperature, you will save 2 to 4 percent of cooling energy, he says.

10. Improve airflow and data center design.

There are methods to improve airflow that range from simply rearranging the perforated floor tiles to implementing a hot-aisle/cold-aisle configuration. Install energy-efficient lighting and retrofitting cooling systems with variable speed motors, so they generate less heat and use less power.

Rather than convert power to 120 volts, run equipment at higher voltages such as 208 to 480 volts. With this approach, power supplies can run more efficiently. Also, using contained cabinets that take air from the floor and vent it directly out the top will dramatically improve airflow, Kosik says.

APC offers many products in this area, including highly efficient in-row fan and chilled water solutions that cool hot spots at the rack level. APC also sells cabinets, called Rack Air Removal Units, that prevent hot air from mixing with cold air.

Green IT Adoption

When CDW surveyed government agencies last year, more than one-third had started green IT initiatives, yet almost 40 percent had no such plans.

- Already implemented green IT: 35 percent
- Planning to implement green IT in next two years: 26 percent
- No plans to implement green IT in next two years: 39 percent

Source: CDW Green IT survey, 2008.

11. Implement remote power and environment management systems in the data center.

IT organizations can install equipment and sensors to measure everything: from the amount of energy that servers, storage, networking and cooling equipment are using, to the temperature and humidity in front of server racks and in every corner of the data center. This provides the necessarily baseline data to allow IT administrators to make the decisions necessary to make their data centers more efficient, which in turn, will help save energy and money.

"Without measuring, you have no basis to try to optimize the data center," says Herman Chan, manager of Raritan's Power Management business unit. "If you don't measure, do you know if you are overcooling or if you have hot spots in certain rows? How do you know if you're just running 10 percent of the nameplate power in any one rack or are about to trip a circuit breaker because you are consuming 80 to 90 percent of the load?"

The data allows IT departments to identify hot spots that need attention, discover cool spots that can take on more servers and locate servers that are good candidates for virtualization. It also allows IT departments to raise the temperature of the data center, and then analyze its effects. Manufacturers in this space include Raritan, Avocent and APC.

Conclusion

The beauty of pursuing a green IT strategy is its multifaceted benefits. Consolidating the data center, purchasing more energy-efficient equipment and deploying applications such as video conferencing and document management improve worker productivity, cut energy consumption and help save money while protecting the environment. Combine all the benefits, and ultimately, they all help government serve its citizens better.

There's no question that going green is trendy these days. But, for local, state and federal government IT leaders, it's also smart and it provides real return on investment.

Energy and Temperature Monitoring Tools

Several manufacturers offer tools to monitor energy and temperature in the data center. Here's a quick rundown of manufacturers and their offerings:

- **Avocent** offers centralized power management software and a family of power distribution units (PDUs). Its rack PDUs can monitor power usage either at the strip level or down to the individual outlet and remotely turn equipment on and off. Internal sensors can also measure temperature to detect whether a rack is running hot compared to the general room temperature.

  Avocent's DSView 3 Power Manager software enables IT administrators to analyze the energy consumption, capacity and cost across a single power outlet, individual power distribution units, a single rack, a row of racks or even the entire data center. With the software, IT departments can set thresholds on power and temperature and receive alerts before situations become critical, such as equipment overheating or circuits overloading.

- **Raritan** offers a family of intelligent PDUs that enable IT administrators to remotely measure power usage, temperature and humidity at regular intervals, such as every hour, every few minutes, or even every few seconds. The PDUs measure down to the individual outlets that servers plug into.

  Raritan's analytic software, a web-based interface, delivers trend analysis and reports. IT leaders can track improvements in energy savings and find available rack capacity, as well as receive e-mail alerts if problems arise, such as a power supply failure.

- **APC** also offers PDUs and Capacity Manager software, which allow IT administrators to analyze airflow, identify energy capacity throughout the data center and also model new data center designs. Through modeling, IT administrators can analyze the effects of alternative layouts.

- **Cisco** has released EnergyWise, energy management software that can measure the energy consumption of its Catalyst switches as well as IP devices such as IP phones, wireless access points and video surveillance cameras.