

Managing the information that drives the enterprise

STORAGE

turning storage green

Addressing power, space and cooling issues for storage not only helps the environment, it saves money and space for data centers with strapped budgets and limited room.

also inside

- Storage hogs power 4
- Tips to save power 8
- Power-saving options 15
- Seeking more metrics 19
- Vendor resources 22

Time to cut storage power

By Rich Castagna

STORAGE SYSTEMS have been immune from the scrutiny of data center managers who pored over power requirements of computing gear looking to trim electric and cooling costs. Because the server side of the shop tends to get more notice than workmanlike storage systems, it got most of the power-cutting attention. But things have changed and—blip!—storage is all over those screens these days.

Many shops have had success in reducing server power consumption with blade systems and server virtualization. With servers sipping less and less juice, attention has fallen squarely on storage systems that consume anywhere between 24% and 40% of total IT power usage and stick out as the biggest power hogs in the data center.

It'll take shrewd planning, an understanding of a new set of metrics and a little legerdemain to find ways to reduce the power consumption of storage gear and still provide the capacity the company wants. Storage vendors are well aware of this new exigency, preparing new products or enhancing existing ones to help storage managers stem the tide of power consumption.

But just slapping the word “green” on a product does little to ensure that it will provide some electrical relief. Data reduction will also play a key role in any power-conserving efforts. You'll probably have to adjust some of your internal data management processes to ensure that you're not running up excessive power bills by spinning too many disks.

You also need to determine what metrics you'll need to accurately measure power consumption in your shop and the results of your efforts.

If this hasn't happened to you yet, it will. Someone in your organization will put together storage and electrical use, and you'll be on the hot seat. This eZine will get you started or, if you're already in the midst of a power-pruning project, help you further along your way. ☺

Rich Castagna (rcastagna@storagemagazine.com) is Editorial Director of the Storage Media Group.

With servers sipping less and less juice, attention has fallen squarely on storage systems.



Did you know you can reduce your storage costs—and help the environment?

The pressure is on businesses to consider the impact that storage technology has on the environment. And it's not hard to see why. A leading industry analyst, for example, has demonstrated that for every watt of machine power consumed, a staggering 1-1.5 watts is typically required for cooling.

This translates into a heavy cost both financially and for the environment.

It doesn't have to be this way. At Hitachi Data Systems, we take this issue very seriously and have written a briefing paper—"Five Cost-effective Steps to Building a More Eco-friendly Data Center"—that will help you develop and implement a less costly and greener approach to storage.

It will advise you how to:

- Reduce data center hot spots
- Implement virtualization strategies
- Consolidate storage
- Deploy services to help design the right infrastructure
- Consider the environmental track record of your vendors

Our own commitment to the environment

Indeed, storage solutions from Hitachi Data Systems are designed to be both cost and energy efficient. "ITCentrix's analysis of market-leading high-end storage solutions shows that for an I/O-intensive configuration of 134 terabytes, competitive solutions consume from 30 percent to 64 percent more budget for power, cooling, and space than comparably configured Hitachi USP Vs* using virtualization and dynamic provisioning," said Dave Vellante, president and CEO of ITCentrix.

Download the briefing paper today

Act now. Reduce your carbon footprint and energy overheads. Download the briefing paper and see how simple it is to make a change for the better.

* Hitachi Universal Storage Platform™ V models

STORAGE HOGS POWER

Disk storage is catching up to servers in energy consumption. By Dave Raffo

FOR ALL THE TALK ABOUT GREEN STORAGE, the power-saving initiative remains more of a server issue than a disk storage issue. But that may change due to the rapidly increasing rate of data growth and the continuing energy pinch. When Kevin Kettler, CTO at Dell Inc., conducted a power inventory of his company's primary data center, he found that while application servers consumed 40% of the power, storage arrays were a close second at 37%.

With application servers becoming more efficient, it's only "a matter of time before storage becomes the No. 1 consumer of power in the data center," says Nik Simpson, an analyst at the Midvale, UT-based Burton Group. When the New York City-based independent research firm The InfoPro recently surveyed network managers at Fortune 1000 companies, it found that heat, cooling and power

issues were the top pain points for these professionals. While power management is further down on the list of storage side pain points, “People building new data centers are predominantly talking about storage as being a main area for power issues,” says Rob Stevenson, managing director of storage research at The InfoPro.

Still, green storage is more of a dollar issue than an environmental one. And while power and cooling issues are gaining in importance in the storage world, the strategies pursued by storage managers to become more environmentally friendly will likely continue to be driven by dollar signs.

“I’d love to say CIOs of the world are watchdogs of the planet, but we have a very selfish reason for green computing—to save costs,” says Bob Worrall, CIO at Sun Microsystems Inc.

Worrall says Sun’s recent data center consolidation will save more than \$1 million a year in energy bills. By eliminating about 5,000 old servers, network switches and storage devices, Sun estimates it has reduced power consumption by 75% while increasing computing power.

“The whole concept of going green is not about tree-hugging,” says Benjamin Woo, VP of enterprise storage systems at analyst firm IDC, Framingham, MA. “It’s about economics.”

POWER, COOLING AND FLOOR SPACE CONCERNS

Greg Schulz, founder and senior analyst at StorageIO Group in Stillwater, MN, has spoken to more than 1,000 users over the past few months about their green plans. And while not more than 10% have existing green initiatives, at least 80% are concerned with power, cooling and floor space.

Solving power issues makes sense from an economic standpoint. “Power and cooling have a direct correlation to the environment and energy,” says Schulz. “In the U.S., we have a limited supply in electrical energy, and we have limited transmission bandwidth. You use what power you have more wisely, and you might be able to save money and be more efficient.”

According to Schulz, storage-specific power-saving methods include:

- Reducing the amount of data through archiving, data deduplication and compression
- Tiering storage by using more power-friendly media that stores more data without using extra power and even tape
- Improving storage management through thin provisioning and infrastructure resource management

- Using storage virtualization to consolidate storage resources the way server virtualization helps consolidate servers

Companies will weigh the costs of these solutions against long-term savings and the impact they'll have on efficiency. "If you want to save power, shut everything off and put it on tape," says Schulz. "But if you have data that's time-sensitive and performance-sensitive, that's a different story."

CUTTING POWER CONSUMPTION THROUGH DATA DEDUPLICATION

Bob Dixon, chief architect at U.S. Army headquarters at the Pentagon, found a green benefit in reducing the number of his tape libraries. By using data deduplication appliances from Data Domain Inc., the Army's data center was able to cut power consumption. But reducing power consumption wasn't the deciding factor in using the data deduplication technology, he says.

"Our footprint is one-tenth the size of the old tape library systems we used to use and replaced [because of data deduplication]," says Dixon. "I don't know if it's a big issue, but we want to use our space, power and cooling capabilities wisely."

Nearly every data center can do things to help "green" its storage networks, says IDC's Woo. "There's no one solution to being green in the storage space. Different industries will have different requirements that dictate data-retention policies. Even departments within organizations have different requirements." ☉

Dave Raffo (draffo@techtargt.com) is News Director at SearchStorage.com.

Whether it's about economics or ecology, some firms may already be green without knowing it.

HOW TOXIC IS YOUR STORAGE?



THINK GREEN.



With 3PAR, customers can buy half the storage capacity required with traditional storage arrays—reducing energy consumption and the related toxic impact on the environment.

With **Carbon Neutral Storage**, 3PAR purchases carbon offsets for disk capacity sold with Thin Provisioning. So far this program has reduced or offset more than 17,000 metric tons of carbon emissions — equivalent to taking more than 3,000 cars off the road for an entire year.

Get a free report by Aberdeen Group on increasing datacenter efficiency:
www.3PAR.com/thinkgreen



Think Thin. Think Green. Think 3PAR.

Tips to **SAVE** **POWER**

Keep power consumption in mind when evaluating storage products; you should also learn how to measure your storage energy demands and reduce the cost of power consumption.

By Greg Schulz and Rick Cook

POWER AND COOLING ISSUES have become a hot (pun intended) topic for IT-related equipment, especially video monitors, servers, networks and storage systems. The reasons for having an interest in power and cooling can be tied to green initiatives, budget concerns (rising energy prices), or the need to support the growth of your applications and data requirements with an existing power and cooling capability.

Electrical power, along with heating, ventilation and air conditioning (HVAC), have traditionally been an after-thought in the data center. Given the rise in energy prices, green and environmental awareness campaigns, and the continued expansion of IT equipment to support more applications with larger data requirements, HVAC, power and floor space have taken on new importance in many IT organizations.

To improve storage energy efficiency:

- Spin down and power off disk drives when not in use
- Continue some use of magnetic tape for offline, long-term archive data
- Reduce power consumption by placing disk drives into a slower mode
- Use cache, RAM and flash/caching appliances, and solid-state disk
- Consolidate to higher capacity storage devices and storage systems
- Use various RAID levels and tiered storage to maximize resource usage
- Leverage management tools and software to balance resource usage
- Implement performance-efficient storage systems to support consolidation without hurting application performance or stability

Another way to reduce power consumption is to address your data footprint. Try refreshing your technology with a complete storage system replacement or replace the disk drives. In either case, you'll need to account for data movement and migration. For example, you could replace older disk drives of the same or larger capacity with newer generation drives that may have better performance and lower power consumption.

For example, an early generation 73GB (72GB if you prefer) 15,000 rpm 2Gbit Fibre Channel (FC) disk drive consumed about 18.74W (164.16kW annually) of power vs. a current generation 15.5K 4Gbit FC disk drive that consumes 15.24W of power. If you were to go to a higher capacity (say 146GB, 15.5K) 4Gbit FC disk, you could double your capacity with a slight performance boost—assuming you're not doubling or aggregating the rate of I/Os to the disk via consolidation while reducing power from 18.74W to 17.44W. But remember: When consolidating storage to higher capacity disk drives, avoid aggravating performance bottlenecks.

There are many challenges and issues around power and cooling, and a number of solutions and approaches.

A SAMPLING OF WHAT VENDORS ARE DOING

Brocade Communications Systems Inc. is demonstrating how its directors are more energy-efficient than one of its competitors, albeit consuming several watts per demo to do so.

EMC Corp. has released various articles and papers, along with an energy calculator, to support improving and maximizing power usage

via consolidation, as well as leveraging VMware for server virtualization as a power-saving approach.

Hewlett-Packard Co. is focusing on optimizing data center efficiency via improved cooling and assessment services to address immediate and near-term improvements leveraging its experience of consolidating and optimizing cooling in its own data centers.

IBM Corp.’s Big Green initiative focuses on data center (internal and external) optimization for power and cooling, as well as technology improvements across servers and storage.

Sun Microsystems Inc. has partnered with Pacific Gas and Electric Co. to enable customers to qualify for energy rebates by reducing power consumption.

Other vendor approaches include 3PAR buying carbon offset credits to complement its thin-provisioning or storage management virtualization capabilities. Copan Systems, Hitachi Global Storage Technologies and NEC have implemented or made statements of direction around power management schemes, ranging from intelligent multistep power management to simply powering disk drives off to reduce power consumption.

Additional steps you can pursue to address cooling and power issues:

- Turn video monitors and lights off when not in use.
- Cover unused floor openings in computer rooms, and set up cold and hot aisles where one aisle is cool (for intake) and another is hot (exhaust) to avoid hot-air intake by IT equipment. This also reduces air blockage due to cables under the raised floor.
- Understand the facilities impact of deploying new technology, including floor weight loading, power requirements (connector type, kVA, phase) and cooling needs.
- Explore raising temperatures in facilities, but stay within vendors’ guidelines.

You need to decide which of these approaches meets your specific needs. Be sure to separate marketing “green wash” from approaches and solutions that can be deployed in your existing environment with a realistic return on investment. There are many challenges and issues around power and cooling, and a number of solutions and approaches. The best one for you will be the one that meets your specific requirements. It may vary by location, application service-level needs and the ratio of servers to storage.

You can learn more about power and cooling, the electrical power-generating and transmission industry, and related topics at www.greendatastorage.com.

TIER 1 LUXURY TIER 2 PRICE

WHY CHOOSE?

Priced for You

With the DATABeast you no longer have to choose. No more trading the features you want for the price the others charge. DATABeast is an all-in-one data storage system with the luxury features of Tier 1 management, scalability, and energy-savings at a price any organization can afford. Tier 1 luxury, Tier 2 price.

Built for You

The DATABeast is the most versatile storage available designed specifically to meet the widest range of storage needs. You can grow to several petabytes, address different applications and deliver tiered storage in one complete system. The DATABeast provides the latest in high performance intelligent technology with a green, high density and field-proven design. The DATABeast is the only storage system you may ever need.

Green for You

Storage accounts for a large part of a data center's energy use and the DATABeast can save you up to 60% on power over other enterprise storage arrays. With industry-leading AutoMAID technology, the DATABeast reduces the cost of powering and cooling disk drives without compromising application performance. Save energy, save money with the DATABeast.

Run by You

Other solutions aren't simple to install or easy to use. The DATABeast is. It comes with a team of consultants virtually designed in. With the DATABeast you can set up an enterprise system on your own. The DATABeast eliminates all the issues and problems of installation with a pre-mounted, cabled, configured, and tested system. Roll it in, plug it in, and you're ready.

[To find out more about the DATABeast click here.](#)



DATA~~A~~BEAST

Powered by  Auto
MAID
Ultra Green Storage

MAKING IT GREEN: WHERE TO START

The first step when looking at greening your storage is to know how much energy your storage consumes and how much that energy costs. You should be able to get the basic numbers on power consumption and heat production from the makers of your arrays and other equipment. If not, you can measure power consumption yourself.

To measure the energy consumption of your storage, meter the power consumption of the circuits feeding the storage devices and the air conditioning. Your facilities management people may be doing this or you may be able to install temporary meters on those circuits. Once you know how much electricity your storage uses (and how much energy cooling the data center uses), the next step is to calculate your costs.

To do that, you'll need to know your electric rate. Because commercial electric rates are based on a number of factors, this isn't as easy as multiplying kilowatt hours times a rate. What's more, rate structures vary by utility company. There is no "standard" electric rate for commercial customers.

Almost all electric rates include a basic service charge that you pay even if you use no power, and a cost based on the amount of electricity you use. Beyond that is where the variables come into play. For example, many electric utilities charge their commercial customers (the class your data center likely falls into), for power consumption on a step basis: so much per kilowatt hour for the first x kilowatts, a higher rate for the next block of kilowatt hours and so on. Some utilities also have different prices depending on the season and time of day. Others have a ratchet mechanism where the minimum charge is determined in part by the highest monthly consumption in the previous 12 months.

Your electric utility can provide you with the rate information; it may even offer assistance in calculating your energy costs and ways to help you save.

Look for simple changes you can make to save energy and reduce cooling loads. For example, changing the filters in your environmental conditioning system more often may save a surprising amount of energy. Putting your data center cooling on a separate zone can also

The first step when looking at greening your storage is to know how much energy your storage consumes.

save money by giving you finer control over your cooling load. You can cut your total cooling load in the data center by redistributing the air flow to your servers and arrays to make more efficient use of the cooled air. Remember that what you're trying to cool is the equipment, not the room. Make sure air flow to the devices isn't obstructed by other equipment.

Another way to reduce power usage is to plug air leaks bleeding cooled air out of the data center where it's needed and into areas where it isn't. In effect, this means weatherstripping the data center. Another possibility is simply turning off equipment when it's not in use. If you don't need most of your storage arrays during nonwork hours, you can shut them off to save power. ☉

Greg Schulz is the founder and senior analyst at StorageIO Group, an IT infrastructure and consulting firm.

Rick Cook specializes in writing about issues related to storage and storage management.

*batteries not included

EcoStor™

Environmentally and economically sound

Super Caps

Super caps and compact flash enhance data integrity by eliminating batteries

SimulCache™

Industry-leading cache design targeted at high performance requirements

AssuredSnap™

Embedded snapshot technology assures advanced data management

AssuredCopy™

Designed for flexibility and support for evolving product needs

Tiered Storage

Intermix up to 108 SAS and SATA drives

Modular Host Interface

Four port 4Gb fibre channel/3Gb SAS/1Gb iSCSI
Eight port enterprise version available with NEBS certification and DC power option

Customize

User interface, documentation and physical features to promote your brand

For more information visit:
www.dothill.com/EcoStor

The R/Evolution family of disk RAID storage systems from Dot Hill has completely eliminated the need for cache batteries. True green storage from Dot Hill's unique EcoStor technology program.



POWER- SAVING options

*Fewer conversions, smaller disk drives
and MAID reduce consumption. [By Beth Pariseau](#)*

JUST AS THE POWER CRUNCH, which began in the server industry, has become the future for storage, the approaches to fixing the problem may originate there as well. According to some experts, research on the server side into methods to reduce the number of power conversions required to get energy from a wall socket into a computer could drastically reduce power consumption in servers and storage if the methods were widely adopted. In many data centers, converting between alternating current (AC or wall power) and direct current (DC or battery power) takes multiple steps, says Don Beaty, an IT consultant with DLB Associates and a member of the ASHRAE TC 9.9 Committee, which focuses on data center power and cooling issues.

“From the utility source down to the server, and then within the server, there are multiple conversions occurring, each of which represents some loss of energy,” says DLB Associates’ Beaty. Bill Tschudi, principal investigator for the applications team in the environmental energy technologies division at Lawrence Berkeley National Lab (LBNL), says he’s working with server vendors, the U.S. Department of Energy and the Environmental Protection Agency (EPA) to find a standard voltage and to redesign servers to take “direct” power or power directly from a DC-based uninterruptible power supply at a standard voltage level to solve this problem.

Although Tschudi’s group hasn’t begun working with storage manufacturers, the issue of power conversions can be applied to virtually any computer. Today’s motherboards also perform multistep, inefficient conversions between voltage levels, many of them based on outdated designs from the 1970s and 1980s, when chips needed multiple voltage levels. Moreover, cutting down on conversions could be the closest thing to a magic bullet when it comes to reducing power consumption in the data center. “Even against the most efficient of today’s power supplies, direct power improved efficiency 10% to 15%,” says Tschudi. “Against the average conversion system, you could be talking more like 20% to 30% if this is adopted on a wide scale.”

THE UPSHOT FOR THE STORAGE MARKET

It’s unclear in which direction the storage industry will move. Some vendors, like Sun Microsystems Inc., are gung-ho about standardizing voltage levels within arrays as soon as 2.5-inch form-factor drives are here. “Right now, typically you have 5 volt and 12 volt conversions within enterprise systems,” says Chris Wood, CTO of Sun’s storage group. Wood says the higher voltage is necessary to spin 3.5-inch drives at high rpms, but once small form-factor drives hit the market, they’ll require smaller engines and less voltage, and could make the 12 volt conversion obsolete. “The whole industry is moving to small form-factor drives,” says Wood. “This is one of the reasons why.”

One storage vendor that’s been playing an “observational” role with LBNL’s efforts, according to Tschudi, has been NetApp. “They’ve been observing this [conversion] project and have done some work with us when it comes to improving efficiency in their own data centers through improved cooling designs,” he says. Brett Battles, NetApp’s director of storage marketing, says his company hasn’t been heavily involved in LBNL efforts to date. “We are continuing to evaluate new power supply offer-

ings, but at this time we don't have any specific details to discuss due to the early stages of the evaluation process." Hitachi Data Systems is another major vendor eyeing the direct power option. "While it is early in the discovery process, we are investigating the use of DC power and other energy-saving alternatives," says Claus Mikkelsen, chief scientist.

THE BATTLE BETWEEN RELIABILITY AND EFFICIENCY

Storage system manufacturers Xyratex Technology Ltd. and Dot Hill Systems Corp. offer some systems designed for direct power. But Ken Claffey, Xyratex's product lead for power supplies, says reducing power in storage systems isn't as simple as cutting out conversions or even building a better power supply. "Storage systems are limited [in terms of power-efficiency development] by two things: the need to power disk drives at a high rpm and the need for redundancy and reliability," says Claffey.

In the interest of high availability, even the most efficient power supplies are typically overprovisioned for the highest load in storage systems, even if it's twice the level the system needs. Xyratex is looking for higher efficiency power supplies, but, says Claffey, there's a "battle between redundancy and efficiency." Xyratex is examining a kind of dynamic load balancing for power supplies that would let them change voltage according to system workload.

Dot Hill Systems says there are better methods for reducing storage power consumption than focusing on conversion. One of them is MAID, which Dot Hill says it has in the works.

Users and the government are taking notice. The EPA submitted an energy-efficiency report to Congress in May 2007 focusing mainly on servers, but breaking out what it calls "first-order estimates" on storage devices. This preliminary report estimates that the energy costs of total enterprise storage systems—the networking, controllers and switches that surround the disk drives themselves—would be 50% higher than the energy costs of the hard drives alone. ☉

Cutting down on conversions could be the closest thing to a magic bullet when it comes to reducing power consumption in the data center as a whole.

Beth Pariseau (bpariseau@techtargt.com) is the Senior News Writer at SearchStorage.com.

Managing the information that drives the enterprise

STORAGE

Exclusive Extra for Storage Subscribers

keep it legal

Tips and
best practices
that will improve
your data
compliance
processes

Compliance Best Practices

For storage pros, it's easy to let 'Update Compliance Processes' slip to the bottom of the to-do list. It can be complicated and you don't always know when you're actually done. To help out, check out the latest *Storage* eZine, a soup-to-nuts guide to help you keep abreast on regulation changes – with several tips on shoring up your processes:

Get Your FREE Copy Today: www.SearchStorage.com/compliance_ezine



SEEKING more METRICS

Everyone's trying to measure power usage in data centers. So why do storage-specific metrics remain elusive? By Trina McDonald

IT POWER CONSUMPTION is getting more attention these days. The U.S. Environmental Protection Agency's report to Congress in August 2007 stated that the amount of energy consumed by servers and data centers, including storage, has doubled in the last five years, is expected to double again in the next five years and will cost \$7.4 billion annually. So it's clear why nonprofit organizations such as The Green Grid—a consortium of IT firms promoting energy efficiency through user-centric metrics, standards development and best practices—are trying to measure data center power usage. Still, storage-specific metrics remain elusive.

“I don’t know of an organization that’s been formed that’s storage-specific,” says Rick Nicholson, VP of research at Energy Insights, Framingham, MA. “They’re all tending to focus on either ... metrics for the entire data center or they tend to be fairly server-centric.”

Representatives from The Green Grid claim to have storage-specific initiatives on their long-term roadmap but declined to discuss it further. Other groups working on power benchmarks include the Standard Performance Evaluation Corp. (SPEC), which released its first-generation SPEC power benchmark in December 2007. But again, this benchmark focuses on server-class computers.

One major reason storage power metrics are so difficult to set, says Roger Tipley, senior technologist at Hewlett-Packard and a board member at The Green Grid, is that storage requires hard drives to spin continuously for performance. “I’m sure there are ways to go out and construct storage arrays that turn off all your hard drives and turn them on only when you need them,” says Tipley. “But depending on your application and your service-level agreements, that may or may not play well.”

The best way for storage managers to help lower data center energy consumption is by using storage products architected to reduce power usage. “The storage vendor community is ahead of the rest of the market in addressing power and cooling issues, energy efficiency-type issues,” says Nicholson. For now, they’ll have to do that without storage-specific metrics. ☉

Trina McDonald is a freelance writer.

Fact or Fiction: A Green Data Center is On Your 2008 To-do List

Expert Podcast: Q&A on Green Storage



Nik Simpson



Peter Bochner

Is this statement true?

Download this Podcast with Nik Simpson analyst with The Burton Group and SearchStorage.com site editor Peter Bochner as they discuss trends in green storage, distinguishing industry hype from what storage managers are actually doing in the real world. Download this On-Demand Podcast—Q&A on Green Storage in the SearchStorage.com Special Report on Green Storage At:

www.SearchStorage.com/green_storage

Sponsored by:  **3PAR**
Serving Information



The Web's best storage-specific information resource for enterprise IT professionals

TechTarget
Storage Media



STORAGE

Storage Decisions

Check out the following resources from our sponsors:



[Next Generation Fibre Channel Storage Systems Market Forecast 2007-2011](#)

[Green Initiatives: Lowering Costs and Increasing Efficiency in the Data Center](#)

[Classified Ventures Wins with Utility Storage](#)



[Dot Hill Homepage](#)

[Dot Hill Ecostor](#)

[Dot Hill Solutions](#)

HITACHI
Inspire the Next

[Hitachi Dynamic Provisioning Software at United Airlines](#)

[Meeting Data Storage Challenges with Eco-friendly Solutions](#)

[The Eco-friendly Data Center](#)



[Find out more about the energy saving DATABeast](#)

[Find out more about AutoMAID Ultra Green Storage](#)

[Learn more about MAID 2.0; download the StorageIO group's new white paper](#)