

GUIDE TO GREEN STORAGE **MAKE AN ECOLOGICAL** **DIFFERENCE**

Waste. It's what your data center is making of your energy and money with today's storage arrays. By the time you finish this paper, the storage infrastructure within your data center will have just pushed up to 70% more carbon into the atmosphere and consumed up to 70% more power than it needed to.

The environmental and economic responsibility of our age is demanding more. A lot more. Discover how you can maximize storage power efficiency without sacrificing storage performance or incurring special costs to get it.

KEY QUESTIONS

TO ASK:

Which vendors offer the most ecologically friendly storage solutions?

- Which vendors offer green solutions?
- What kind of solution do they offer?
- How are they different from other vendor offerings?

How much of a reduction in power consumption and carbon production can be expected over a typical array?

- Are claims validated by lab reports?
- Can claims be substantiated by customers in the real-world scenarios?

Are there performance penalties to be expected in exchange for power efficiency?

- What kind of applications can their green storage technology support?
- Can the vendor's green storage technology be leveraged in SAS environments as well?

Do green storage technologies incur additional expense?

- Is the vendor's green storage technology included with the cost of storage, or is it additional expense?
- Are there associated license fees?

WASTE

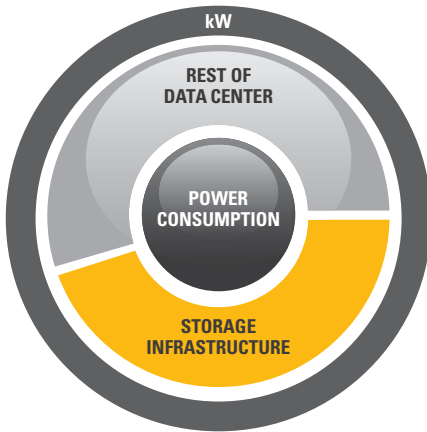
It's what your data center is making of your energy and money right now with today's storage arrays. By the time you finish this paper, the storage infrastructure within your data center will have just pushed up to 70% more carbon into the atmosphere, consumed up to 70% more power and up to 70% more cooling than it needed to. Over a year, a typical 42TB storage solution will push 8.9 metric tons of CO₂ into the atmosphere that otherwise could have been completely eliminated by a power efficient storage subsystem that meets or exceeds all the same performance, reliability and cost requirements demanded by your business.

It's easy to 'tune out' those kinds of talking points as IT professionals have grown more and more cynical of vendor marketing that always seems to over-promise and under-deliver. But if green initiatives play a role in your organization's priorities, power consumption solutions to the storage infrastructure are one of the easiest to implement and, thus, belong at the top of IT consideration.

CLEARING THE AIR ON GREEN STORAGE

In an age of energy awareness, somehow the storage infrastructure within data centers has largely flown under the radar. Public awareness of ecological conservation is turning off lights, replacing incandescent bulbs, innovating greater levels of vehicle fuel efficiency, all while IT professionals continue to purchase and use the same growing amounts of storage that are consuming more power and pushing more carbon than they did ten years ago.

In a world that has moved from incandescent to fluorescent, the vast majority of data centers are still using the same wasteful, storage systems that haven't kept pace with power efficiency progress. Sure, vendors want to jump on the "green bandwagon" and claim "green storage" when, in fact, the only thing green about their storage is the color of the box it came in and the additional cost of the software you had to buy. It's become harder and harder for IT professionals so see through the green smoke screen of vendor marketing.



ELIMINATE WASTE

By utilizing power efficient storage systems, IT professionals can reduce this figure by 70%

■ The storage infrastructure in most data centers consumes roughly 40% of the total power distributions

The dirty secret is that some storage vendors feel justified to make a “green claim” when making the most minor of power efficiency improvements, e.g. a slightly improved power supply or the promise of a piece of software to utilize less storage which just costs you more money in the end. The way some companies try to stake a claim in the “go-green” trend is akin to a monster truck going green with recyclable seats.

Storage vendors try to reduce the wattage of a fan while their disks needlessly spin at full speed when idle and call it a “green solution.” And of those who spin down, most deliver a green storage benefit that comes at the price of performance — a price not many applications can afford.

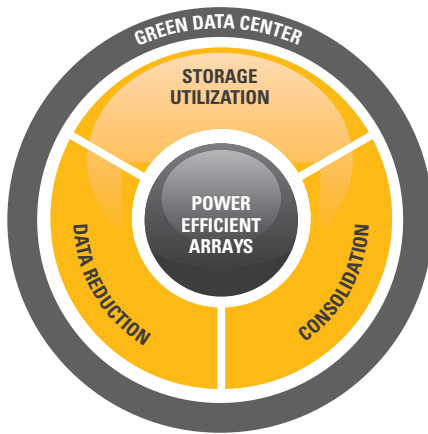
The world of green storage marketing is so upside down that one storage system, which reduces power consumption by a meager 1%, can sit right next to another storage system that can reduce power consumption by a whopping 70%, and both are marketed as “green solutions.” More than ever, IT professionals have to look past “green claims” and inspect actual consumption reduction.

THE GREEN OPPORTUNITY IN TODAY'S STORAGE INFRASTRUCTURE

The economic and environmental responsibility of our age is demanding more from disk storage vendors. A lot more. That's why companies like Nexsan are revolutionizing the storage industry with up to 70% in energy savings without a storage performance penalty — “Speed with Green.”

One of the reasons that storage energy waste has largely flown under the radar in the data center is because so much attention has been placed on the largest consumer of energy and capital expense in the data center — servers. However, with the advent of server virtualization and blade servers, IT professionals have made significant power improvements on the server level. Now that the server power problem is being addressed, attention has turned to the second largest consumer of power in the data center — storage.

While servers may be the largest consumer of power in the data center, storage is not far behind accounting for 40% of all power consumption in the data center. Kevin Kettler, CTO at Dell conducted a power inventory of his company's primary data center and found that storage arrays consumed just 3% less power than the application servers.



4 STEPS TO A GREENER STORAGE INFRASTRUCTURE

- Utilize power efficient storage arrays
- Increase existing storage utilization with virtualization and thin provisioning
- Reduce storage with deduplication and compression
- Consolidate data to more power efficient tiers

With application servers becoming more efficient, it's just a matter of time until storage becomes the top consumer of power, the largest producer of carbon and most significant source of waste in the data center. And with 50% aggregate data growth year over year, the power inefficiencies of today's arrays can hardly be tolerated any longer from both an ecological and economic perspective.

To understand the gravity of the problem, one must understand the power footprint of today's data center. It is estimated that 1.5% of all the energy consumed in America comes from data centers, which is equivalent to the power consumption of 5.8 million households and exceeds the total power output of all the coal power plants in the U.S.¹

40% of the power consumed by a data center comes from its storage infrastructure. What if you were told that 40% of your storage power consumption could be dropped by up to 70%, 40% of your data center cooling could be dropped by up to 70%, 40% of your carbon production could be dropped by up to 70% and 40% of your power distribution inefficiency could be dropped by an additional 70% at the meter? The cumulative effect of a storage subsystem that is 70% more power efficient than a typical storage system reduces the total ecological footprint exponentially.

A single watt saved on the drive level does more than just save power consumed by the drive; it ripples throughout the entire cooling infrastructure, power distribution infrastructure and ultimately slashes the carbon production from all three sources. For every watt saved on the drive level, roughly 3 watts end up being saved at the meter.² (for more, see the "Power/ Density Paradox" White Paper).

BUILDING THE GREEN STORAGE INFRASTRUCTURE

It's this level of ecological impact that Nexsan's AutoMAID™ technology is saving on the environment which has forced the conversation around the responsibility to utilize power efficient storage. Following Wikibon's Lab Report on AutoMAID, Pacific Gas and Electric company started offering rebates to data centers that leverage Nexsan's exclusive AutoMAID technology. Real-world customers like CalTech, who store 2 petabytes of critical NASA data on Nexsan storage, depend on AutoMAID level 1 and level 2 to dramatically cut their power consumption while meeting all their performance requirements (for more, see the Nexsan case study, "CalTech relies on Nexsan Reliability and Power Efficiency to Store Two Petabytes of Critical NASA Data").

¹ Source: Report to Congress on Server and Data Center Energy efficiency Public Law 109-431. U.S. Environmental Protection Agency ENERGY STAR program

² Energy Logic: Calculating and Prioritizing Your Data Center IT Efficiency Actions, Emerson Network Power

Whereas companies ignored the benefit of old MAID technology due to performance limitations, AutoMAID has changed the game by delivering “Speed with Green” — up to 70% energy savings with sub-second response times to the first I/O and full speed to every subsequent I/O to deliver power efficiency even in the most performance intensive environments.

Up to this point, the largest efforts to reduce storage power consumption and carbon production have revolved around data reduction efforts (via deduplication, compression) and increased storage utilization (via thin provisioning and storage virtualization).

Most industry outlets talk about the virtualization of servers and storage as the best way to “green” a data center. However, as much as it is a step in the right direction to lower the number of arrays being used, it still doesn’t address the inherent power inefficiencies of today’s storage systems. It’s akin to a policy to reduce traffic without addressing the fuel efficiencies of the vehicles on the road. A much more holistic approach is to reduce traffic while increasing fuel efficiency.

That’s why technologies like thin provisioning and virtualization should be considered the LAST step in moving toward a green data center, whereas the FIRST step is utilizing storage systems that consume less power and cooling to deliver the lowest carbon footprint per storage density.

AUTOMAID COMPARISON

	Ordinary Disk Array	Nexsan SATABeast	Difference
No AutoMAID Annual kW	770,179	479,297	60.69%
Using AutoMAID 1 & 2 Annual kW	n/a	132,777	480.05%
Annual Cost @ \$.12 kW (compares ordinary disk with Nexsan’s AutoMAID 1 & 2)	\$92,421	\$15,933	480.05%

Not to mention, the downside to a deduplication or thin provisioning implementation is the associated additional expense to use the technology. On the converse, AutoMAID spin-down technology comes free on all Nexsan storage units to deliver 70% reduction in operating expense and carbon production over a typical storage array that would otherwise be purchased to keep up with data growth demands.

Some would argue the reason for the lack of adoption of green storage, and the associated ecological and economic benefits, has to do with the fact that data centers are performance dependent and that green technology represents performance limitations.

The assumption is true if referring to early green technology like MAID (Massive Array of Idle Disks) that was introduced by Copan. The idea was good, but the performance penalties of an “On/Off” approach were so significant that only a handful of applications could leverage the technology. Similar “On/Off” technologies are used in other storage array offerings today.

However, with the advent of MAID 2.0, otherwise known as AutoMAID™, Nexsan realized the collision between power inefficient arrays with data center performance priorities and innovated “Speedwith Green” — spin down technology that could be used in any environment with most applications. By delivering the benefits of green without performance limitations, AutoMAID delivers a level of flexibility that slashes power consumption and works in every environment — from transactional on SAS, all the way down to archive and backup on SATA (see “MAID 2.0 — Energy Savings without Performance Compromise” by Greg Schulz).

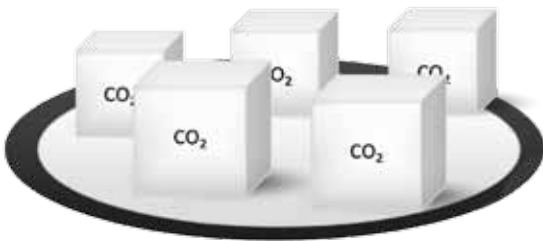
As much as the economic advantage of AutoMAID can be easily understood, just as valuable, but less understood, is the ecological advantage.

THE CARBON FOOTPRINT OF TODAY'S STORAGE ARRAYS

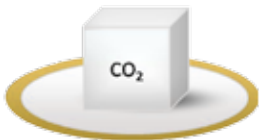
Ecologically, since the industrial revolution, increased amounts of greenhouse gases have been emitted into the atmosphere — dramatic increases in CO₂, methane, tropospheric ozone, CFCs, and nitrous oxide. The concentration of CO₂ alone has increased by 36% since the mid-1700s. These levels are considerably higher than at any time during the last 650,000 years — the period for which reliable data has been extracted from ice cores. Less direct geological evidence indicates that CO₂ values this high were last seen approximately 20 million years ago. Fossil fuel burning has produced approximately three-quarters of the increase in CO₂ from

Over the course of a year, a typical 42tb storage solution will push 8.9 Metric tons of CO₂ into the atmosphere that could have been completely eliminated by an equivalent nexsan power efficient storage system.

TYPICAL DISK ARRAY



NEXSAN SATABEAST



human activity over the past 20 years. The remainder is due to land-use change — deforestation in particular. The issue of climate change has sparked debate about the benefits of limiting industrial emissions of greenhouse gases versus the costs that such changes would entail.

EPA Administrator, Lisa Jackson, announced in Copenhagen that the agency had finalized its finding that greenhouse gases, including carbon dioxide, pose a threat to human health and welfare. The EPA will soon begin regulating greenhouse-gas emissions from power plants, factories and major industrial polluters. Data center regulation is only a matter of time. In the U.S., The House has already passed a bill that would cap U.S. carbon emissions at 17% below 2005 levels by 2020. The Senate is considering similar legislation.

While global warming is not solved by any single action, the balance is dependent upon the cumulative effect of everyone doing their part. As individuals, the responsibility trickles down to things as simple as turning off a light or moving to a high-efficiency bulb to decrease one's carbon footprint. In the data center, the problem is drastically larger, but, in many ways, very simple to solve.

GREEN STORAGE BEST PRACTICES

A variety of best practices can help us better understand efficiency. In storage, there are three things to consider to improve energy efficiency:

- The additional energy consumed because of inefficient devices
- The additional capacity required because of inefficient management
- The additional floor space required because of inefficient packaging

Concentrating on these three areas of data center efficiency, Nexsan has focused its engineering efforts on solutions that cut costs and lead the industry in ecological leadership.

For example, consider a typical 42TB storage solution. Nexsan's SATABeast can reduce each key metric by more than half when it comes to power, cooling and CO₂ emissions when compared against other storage arrays on the market with, or without, virtualization and thin provisioning. Table 2 is based on a modest configuration. SATABeast uses a dense package and offers a 70% reduction in power over a typical disk array. With SATABeast, users have the ability to get more capacity onto a floor tile while reducing power consumption at the same time.

In ecological terms, the savings are also impressive. For example, by reducing power and cooling consumption by 70%, the amount of CO₂ pumped into the atmosphere drops from 12.8 metric tons to 3.9 metric tons. That is essentially equivalent to the amount of energy used to power 7.73 single-family homes. Note that the above savings is considered with only a modest amount of storage capacity.

ENERGY COST COMPARISON

Year 1 ECO Metrics	Typical Disk Array	Nexsan SATABeast	Difference
Power (kWh)	13,447	4,097	70%
Cooling Power (kWh)	12,102	3,688	70%
CO2 Metric Tons	12.8	3.9	70%
Storage Density (Disks per U of space)	4	10	60%
3-Year TCO (CAPEX & OPEX)	\$205,521	\$104,008	49%

CONCLUSION

With the convergence of our current ecological challenge, we are all faced with our own individual responsibility. No single action can solve all of the problems we face today, but we can't ignore that the best solution lies in the accumulation of many small changes.

By harnessing the power of Nexsan's AutoMAID technology in disk arrays followed by consolidation and virtualization, as well as deduplication, IT professionals can greatly reduce their data center carbon footprint while cutting costs as well.



For more on Nexsan storage solutions, visit www.nexsan.com and talk to a Nexsan storage specialist for a free consultation on how to implement industry leading storage efficiency.

Our contribution is relegated to the areas we directly influence. So here are some recommendations to help you get started:

- Start an ECO-management initiative
- Set your AutoMAID policy to save power on your disk array
- Store data more efficiently; look into virtualization and thin provisioning to maximize the capacity you already have after you have purchased an energy efficient array
- Utilize technologies like deduplication to reduce the amount of data stored
- Consolidate infrequently used data and use higher levels of energy saving technology against that data

ABOUT NEXSAN

Nexsan Corporation is a leading provider of energy-efficient, long-term storage systems. Nexsan delivers secure storage appliances and modular, capacity-optimized disk-storage systems for a broad range of applications including fixed content storage and archiving, email, medical imaging, compliance and litigation support, disk-based backup, digital video security, and rich media.

Nexsan's solutions are the choice of small and medium-sized companies as well as large global enterprises and major governmental agencies around the world who are seeking cost-correct, high density storage solutions. Founded in 1999 and based in Thousand, Oaks, Calif., Nexsan sells its products exclusively through a select global network of VARs, OEMs and system integrators.

For more information, please see the company's website at www.nexsan.com.