



**It Pays to Know Your Data Center:**  
Saving Money through Increased Efficiency

## Introduction: Today's Data Center

Few enterprises today can deny this truism: their data centers are consuming incredible amounts of energy. In a 2007 report to Congress, the U.S. Environmental Protection Agency (EPA) stated that data centers used 1.5 percent of all the power consumed in the United States (61 billion kilowatt-hours) at a cost of \$4.5 billion in 2006. That's enough energy to run 5.8 million households!

Given the magnitude of this usage, the EPA is, at the time of this writing, establishing data center energy standards for 2010. And the EPA is not the only entity taking note of data center energy usage. Company stakeholders are also concerned—especially as energy prices continue to rise.

At the same time, companies want more and more from their data centers. The demand for always-on applications, reliable data delivery, sound security, and sheer horsepower isn't going anywhere. If data centers are to consume less energy, it won't come from decreases in computing power; it will come through increases in efficiency.

## Drivers of Data Center Inefficiencies

What drives data center inefficiencies? In truth, there are many factors. Professional energy audits unearth unique inefficiencies across hundreds of detailed areas. Still, there are some realities that are affecting data centers everywhere—from the best managed to least managed.

### Ever-growing Complexity

Data center inefficiencies grow incrementally as time passes. Each new business application seems to require yet another server. In this way, data centers grow in complexity while at the same time become harder and harder to keep organized.

### Underutilized Assets

Most companies have assets that are drawing power but not working at maximum potential. In a 2009 commissioned study, Forrester Consulting surveyed 185 IT professionals from large enterprises. One-fifth of the respondents reported that 15 to 20 percent of their servers were ghosts—turned on but in a crashed or abandoned state.



### **Fear of Downtime**

Many companies feel that the risks (e.g., possible system failures) involved with energy-saving implementations are just too high. For this reason, even implementations with proven energy-saving results are tabled and moved into planning documents for the future.

### **Over Provisioning**

Many companies build data centers as if all of their systems are of “Tier 4” importance; the reality is that many of their systems aren’t. Palo Alto-based Hewlett-Packard Company estimates that as many as 50 percent of the applications running in a typical data center could be classified as less than business-critical. These applications often do not need the attention and energy they are consuming.

## **The Good News: You Can Reduce Costs and Conserve Energy**

To increase efficiency and lower costs, the first thing you need is information. The more you know about your data center, the more potential savings you’ll discover. Even the most meticulously run data centers have room for improvement. And the solutions are often more straightforward than you may think.

### **Take Inventory**

Before you spend a single cent on data center improvements, you need information about your assets. Good information can reveal the obvious, like ghost servers, for example. But more importantly, good information can reveal the less obvious, like opportunities for server consolidation or cooling unit automation. These opportunities are often based on complex information, such as trends in your system (some servers may only be busy for short periods of time); historic data across multiple, unique applications; and industry best practices.

Many firms specialize in providing this kind of information through data center energy audits. These audits take legwork and detailed information. For example, N’compass (a Minneapolis-based technology solutions company) assesses data centers on more than 150 areas, called Energy Conservation Opportunities (ECOs), when they conduct an audit.

“The notion of assessing your current situation seems rather obvious, but a thorough inventory is a pretty detailed process,” says N’compass Executive Vice President of Solutions Chris Pinc. “Taking the time to do so is really the only way to begin a sound analysis.”

Data center audits, at their best, are comprehensive. They take into account the data center’s equipment, layout, temperature, power levels, airflow, trends, and more. The final deliverable is an all-inclusive report that identifies sources of inefficiency, recommended improvements, and the costs/benefits for those improvements. Armed with the information in these reports, businesses can make educated decisions about their data center’s management and future.

“It’s not unusual for larger-client audits to unearth savings in the tens of thousands,” Pinc adds. “One recent audit spelled out potential annual savings of more than \$545,000. Of course, companies may not opt to invest in every ECO we provide, but armed with the audit results they are able to make better decisions about how to proceed.”

### **Reduce Physical Inventory**

When you reduce the number of physical devices in your data center, two energy-friendly things happen: 1) your power needs decrease and 2) your cooling needs decrease. The problem is that data centers fill up fast. Server sprawl seems to happen over night. The result is a facility full of underutilized machines taking up precious space and energy that their workloads just can’t justify.

Two important practices have developed in response to server sprawl: server consolidation and virtualization.

Server consolidation, just as it sounds, seeks to reduce the total number of servers that an organization requires. This involves combining workloads from separate machines. Sometimes these workloads are heterogeneous; other times, they are diverse and must be combined under the single operating system of the server on which they are being consolidated.

Server virtualization is a method of splitting a single server, or partitioning a server, in a way that allows it to function as if each partition is its own server. Each partition can run its own operating system, and each can be independently rebooted. In this way, multiple operating systems can share the same hardware (and the same cooling resources) with minimal-to-no change to the original applications.

Most applications use around 5 to 15 percent of a server; through virtualization and/or consolidation, five to 20 of these applications can be put on one machine, drastically reducing the number of physical servers in a data center. Today, many companies are using server virtualization aggressively, often at ratios of 30:1.

“The technology surrounding virtualization is mature enough now that companies are more comfortable considering this solution,” says N’compass’ Brad Wampole. “Our clients find it to be a relatively low cost initiative that leads to quick ROI.”

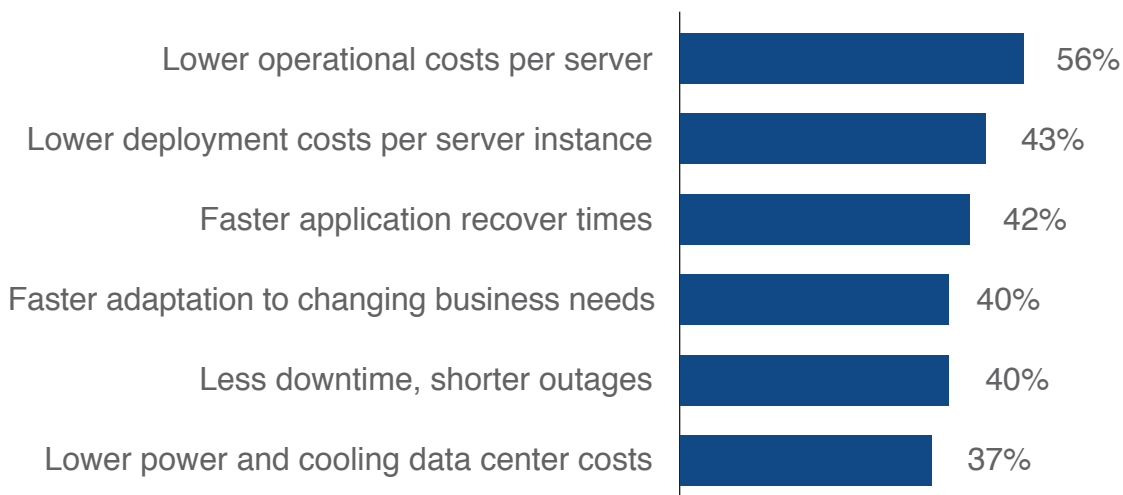
In an energy efficiency report to Hennepin County Medical Center (HCMC), N’compass reported that server consolidation and virtualization efforts could reduce their physical inventory from approximately 30 servers to three. The result? Reduced energy demands.

Server consolidation and virtualization drive a variety of efficiencies (see Figure 1). It should be noted, however, that these efficiencies cannot be realized until detailed information about server ownership and utilization exists. Energy audits are the safest, most efficient, and most accurate way to garner the data that enhances consolidation and virtualization efforts.

HCMC Director of Facilities Tom Bravo saw immediate value in the audit. “Armed with the information N’compass provided us within the audit, we were able to make sound decisions about our approach.”

## Figure 1: Top Benefits of Virtualization

“What business benefits are you experiencing through your implementations of virtualization?”



(Source: Online survey of 185 IT decision-makers conducted by Forrester Consulting on behalf of Hewlett-Packard)



### Improved Technology Selection

Perhaps no other element of your data center benefits more from good information than your plans for the future. Imagine the planning and technology selection involved in eBay’s latest investment: a \$334 million data center in Utah. It’s the single largest investment in capital the online auction giant has ever made.

Mazen Rawashdeh, eBay Vice President of Technology Operations, calls the investment a part of a corporate-level, four-year data center strategy.

“Our business model is unique; we know the rhythms and availability requirements that are specific to eBay’s platform. By designing an environment for our data and compute power—both in terms of physical data center and hardware and software infrastructure that goes into it—we can innovate and manage it in the most efficient way possible.”

As mentioned, the impulse to resist large data center investments is incredibly high; the costs are high as is the potential for downtime. So where do you begin? Where did eBay begin in planning such an investment?

“You need to ask the right people the right questions in the beginning,” says Chris Pinc. “What has your company growth been? Will it continue at this pace? How much reliability or redundancy needs to be built in? Is in-row cooling a requirement? Careful analysis leads to thoughtful planning.”

### Lower Facility Cooling Costs

What can be done to optimize facilities’ energy efficiency? Once again, good information is key. First, you need to understand where the energy is going. IT equipment traditionally takes a lot of the blame when it comes to data center energy costs. In fact, according to the aforementioned Forrester Consulting report, when asked what costs associated with data center infrastructure are important factors in data center efficiency, 30 percent of respondents cited “power efficiency of IT equipment.” But is this a fair assumption?

While it’s true that servers and other IT devices consume a large proportion (often approaching half) of the total energy consumed in a data center, there are other significant draws as well. Energy audits often reveal that cooling systems account for more than 30 percent of the power allocation in a typical data center (see Figure 2). This is interesting, as only 18 percent of respondents in the Forrester Consulting report indicated these draws as an important factor in overall energy costs.

“For every watt of energy used, it takes 1 ½ watts of energy to cool and distribute that energy! You simply cannot underestimate cooling HVAC costs; the fact that the HVAC costs do not typically hit the IT budget creates a gap in understanding the true cost of IT,” says N’compass’ Brad Wampole.

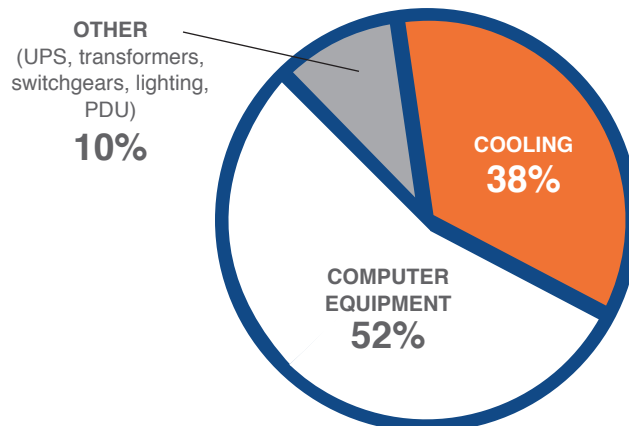
In a perfect world, you would upgrade all the power and cooling infrastructure in your data center to temper these cooling costs. The reality, however, is that these upgrades are time consuming and incredibly expensive; most firms opt to start small. Facilities upgrades that prevent hot and cold air from mixing (see Figure 3) are relatively inexpensive when compared to infrastructure upgrades.

There are often a variety of low-cost, straightforward implementations that companies can utilize to lower their cooling costs. Consider Bremer Bank, a Midwest bank with all the data center needs you might expect: high-level security, 24-hour accessibility, large amounts of storage, etc. Through a partnership with Xcel Energy, a public utility company, Bremer Bank engaged N’compass to identify potential energy savings. N’compass identified a variety of compelling ECOs, one of them being the automation of the starts and stops of two cooling units. This simple measure cut the energy consumption for data center cooling in half.

According to Bremer’s CIO Tom Ryan, “This initiative surprised us in its simplicity, but the projected savings are very real. It’s something that we certainly would have overlooked had we not participated in the audit.”

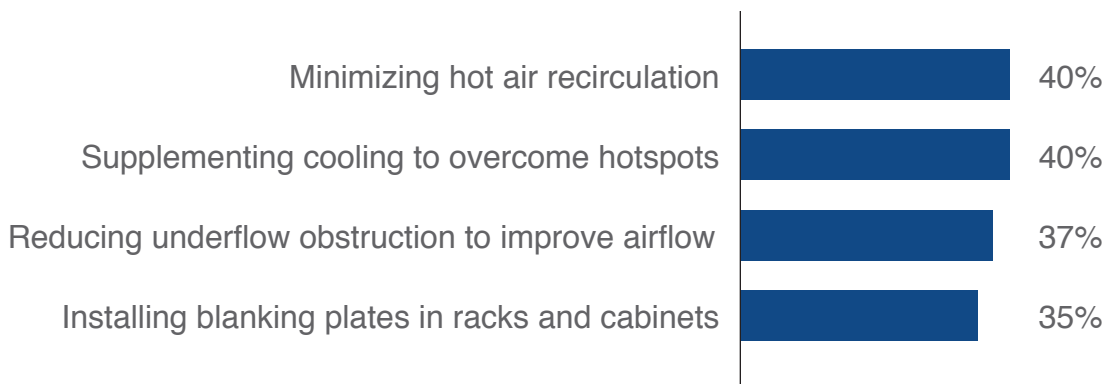
## Figure 2: Power Allocation in a Typical Data Center

(Source: N’compass)



### Figure 3: Closing the Air Gaps

“What upgrades and optimization are you doing to improve cooling efficiency and effectiveness and airflow management in your data center?”



(Source: Online survey of 185 IT decision-makers conducted by Forrester Consulting on behalf of Hewlett-Packard)

### Conclusion: The More You Know, the More You Save

Data center energy audits and the prescribed changes that accompany them may seem daunting. It’s important to remember that, while long-term investments and planning can lower costs, so too can seemingly smaller endeavors.

In 2009, a US Bank employee submitted a “green tip” which suggested that employee monitors be shut down at night. US Bank knew that only about half of their employees were powering down their monitors at the end of the work day.

Through provisioning and IT protocol, US Bank initiated an automated system that powered off monitors that had been inactive for one hour. The result? The company estimates that this one initiative will result in hundreds of thousands of dollars in annual energy savings per year.

Data center success stories like these have good information at their core. Nothing trumps accurate, timely information when it comes to cutting costs and saving energy in your data center. Consider a professional assessment today. Thorough examination exposes opportunities for improved efficiency.