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Symantec 2007
Green Data Center Report

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Symantec Green Data Center Report 2007

Executive Summary

The increasing cost of electricity needed to run data centers is driving most companies to seek solutions that reduce power consumption.

Unfortunately, most managers are being pulled in two directions. Upper-level corporate management and boards want them to reduce the use of electricity, while business managers are not willing to compromise on performance.

As a result, many companies are turning to consolidation/virtualization to meet each group's requirements. Additionally, data center managers are using other technology solutions such as energy-efficient CPUs and power supplies, and more sophisticated airflow, cooling, and heat-removal solutions to reduce their data center's electricity consumption.

Enterprises that participated in this study are spending, on average, $1.4 million per year on electricity for their data centers. If the above-mentioned technologies can cut electrical use by 20 percent, that represents an annual saving of more than a quarter of a million dollars.

At the same time, many companies are adopting green policies that, while applying broadly to the entire organization, are just now starting to influence data center purchasing decisions and long-term strategies. However, the transition to green data centers is likely to be slow.

Internationally, there is much confusion as to what exactly a green data center is. Few organizations currently have green data centers. And only one in seven data center managers say they either have implemented or have begun to implement a green data center. Still, managers note that they are increasingly adopting technologies and strategies to help move their data centers to a new level of 'greenness.'

Symantec 2007
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Chief Findings

Specific actions geared toward 'greening' the data center appear to be limited: Currently, only one in seven data center managers globally has implemented or has begun to implement a green data center. However, an additional 57 percent are in the discussion, planning, or trial stage, with only 29 percent not yet even considering a green data center.

This study sought to better understand respondents' motivations, priorities, and definitions related to greening the data center. The survey and discussions found:

- When asked about their definition of 'green,' 85 percent defined this as increasing the efficiency of energy use; 63 percent defined it as reducing the use of hazardous and toxic materials; and 56 percent defined it as reducing the use of polluting energy sources. (Some respondents had multiple definitions.)
- Sixty-eight percent of respondents indicated that energy efficiency was a high or critical priority in their data center. In addition, 38 percent cited reducing the use of polluting energy sources and 33 percent cited reducing the use of hazardous/toxic materials as a high or critical priority.

One clear motivator behind greening the data center was a sense of responsibility to the community. About two-thirds of the managers surveyed cited this as an important factor. Other factors included cost reduction (44 percent), increase in efficiencies (43 percent), corporate mandates (35 percent), and client/customer requirements (24 percent).

Many managers who participated in the study's focus groups noted that their organizations had adopted corporate social responsibility positions. In some cases, corporate boards have developed a triple bottom line that includes formal metrics to measure economic, social, and environmental success. To meet the environmental objectives, some companies have pledged to reduce total energy consumption, while others have stated their intent to reduce their carbon footprint.

Other factors besides social responsibility are also forcing organizations to make swift changes. For instance, some data centers have reached the limit of the electrical capacity their utility companies can deliver. In such cases, energy-saving measures must be taken to quickly and significantly reduce data center power consumption. The alternative, which some managers reported having to do, is to physically — and expensively — relocate the data center.

The study finds that many data center professionals are turning to software solutions to deal with energy efficiency and green initiatives. At the top of this list is software dealing with server consolidation and server virtualization, which were cited as the most popular solutions, with 51 percent and 47 percent respectively indicating plans to consolidate and virtualize servers. In fact, 68 percent of respondents indicated that energy efficiencies played a role into their decision to implement serve virtualization and consolidation.

When it comes to server consolidation/virtualization, Symantec's 2007 State of the Data Center study found that, in terms of actual implementations, U.S. companies are far ahead of their counterparts around the world. However, while there are fewer Asia-Pacific and Japan (APJ) organizations currently using consolidation/virtualization, more managers from that region cite the reduction of energy

consumption as the reason for doing so. In fact, while 72 percent of U.S. managers said energy-consumption reduction was considered the most important reason — or one of many reasons — in their decision to implement consolidation/virtualization, 88 percent of APJ managers said that was the case.

These trends were evident in the focus groups. Attendees in non-U.S. regions were more likely to mention reducing energy consumption as a factor in making the move, while it was clear that U.S. managers were aggressively adopting consolidation/virtualization for a number of reasons, including simplifying management and reducing operational and energy costs.

Respondents also revealed:
- Energy efficiency is an important factor in vendor selection, according to 37 percent.
- Most data center managers are at least planning to implement power management products. Thirty percent are implementing on selected equipment, 13 percent on equipment throughout the data center, and 34 percent are either planning to use or currently evaluating these products.
- In addition to server virtualization and consolidation, the use of energy-efficient CPUs was the second most popular technology for data center power reduction, with 28 percent citing this as one of the two technologies they think will reduce power consumption.

In focus groups, data center managers noted that while energy efficiency is a priority, it must be balanced by business needs. Specifically, there is constant pressure from the business managers and business units to maintain performance and meet increasingly aggressive service level agreements (SLAs). These internal customers will not accept reduced levels of service simply to reduce power consumption or save money on electrical bills.

Symantec 2007 Green Data Center Report: Study Methodology

To better understand the issues faced by data center managers, Symantec and Ziff Davis Enterprise undertook a global quantitative and qualitative study on the green data center. The study was conducted in September 2007 and focused on the challenges faced by managers in Global 2000 and other large global organizations.

A number of methods were used to gather data and information. These included:
- An online survey fielded in 14 countries (in conjunction with a larger "State of the Data Center" global survey)
- In-person focus groups conducted in Hong Kong, London, New York, San Francisco, and Tokyo
- One-on-one telephone interviews conducted in Mumbai, India, and Singapore
- A teleconference focus group conducted in Canada.

All told, 250 data center managers completed the online survey, and 67 data center managers around the world took part in focus groups or phone interviews. This report also include information from the Symantec 2007 State of the Data Center report, which is based on a survey of 500 data center managers.

All participants in the study are responsible for data center operations. They purchase for, budget for, or manage one or more data centers. Seventy-four percent work in IT; 26 percent oversee IT.

The organizations represented have an average of 31,250 employees; 90 percent of the firms have between 7,000 and 120,000 employees. The typical number of data centers in these organizations is 14 or 15. The typical annual IT budget is $54 million.

(Note: The online survey was hosted by InsightExpress LLC, and field management, tabulation, and statistical analysis was provided by Preference Research LLC. Given the sample size, answer differences in excess of 4.2 percent are statistically significant with 95 percent confidence.)

The Impact of Energy Costs and Usage on Today's Data Centers

Energy costs are going through the roof. Until recently, each new generation of microprocessors and data center equipment consumed more power than the previous one.

Managers who were surveyed report that their current data center electrical expenditures are, on average, $1.4 million a year. And their IT equipment makes the biggest share of that figure.

As IT departments roll out new equipment and applications to support new business operations, power consumption is garnering more attention. If strategies do not change, adding equipment to meet growing business demands will simply consume more electricity and cost more money.

Did you know?

The energy use of the nation's servers and data centers in 2006 is estimated to be more than double the electricity that was consumed for this purpose in 2000, according to the Environmental Protection Agency. Under current efficiency trends, national energy consumption by servers and data centers could nearly double again in five years.
Source: EPA (2007)

Unfortunately, that is not the only factor contributing to the high energy costs organizations face when powering their data centers.
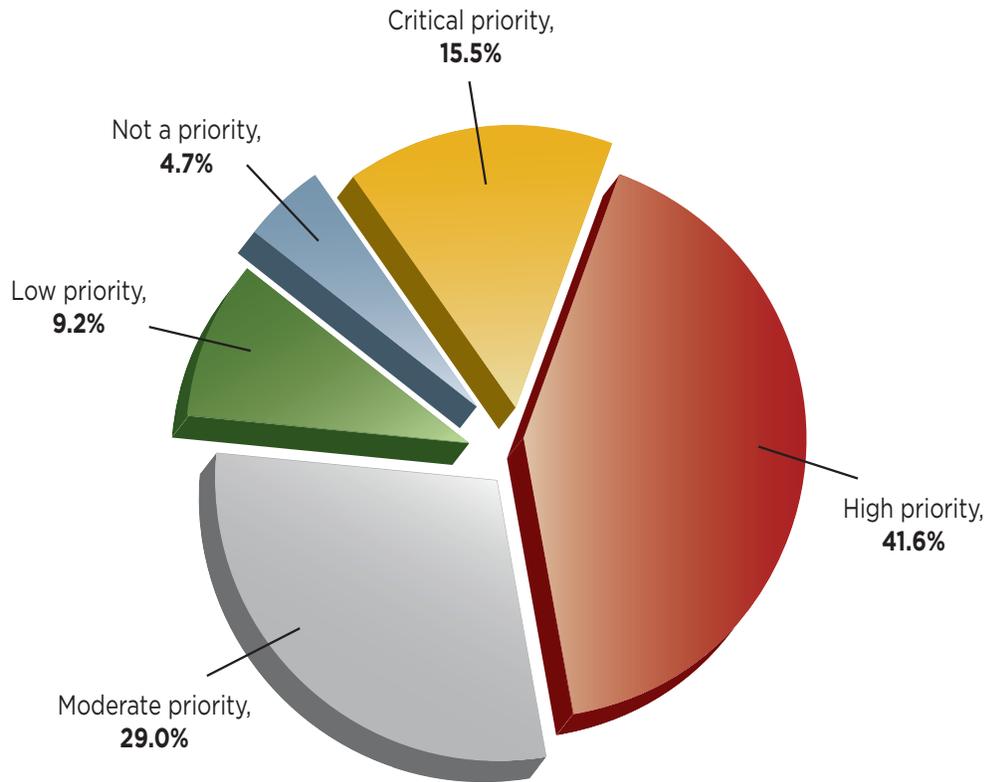
The price of electricity is expected to rise. Even a small increase in the cost per kilowatt-hour (kWh) can have a significant impact. For instance, a company spending 9 cents per kWh today and averaging $1.4 million per year for data center electricity would have to pay nearly half a million dollars a year more if that rate rose to 12 cents per kWh.

Additionally, newer versions of server and storage devices are packed more densely than their predecessors. They deliver more processing power in the same or smaller data center footprint, but they're generating more heat in that smaller space, too. As a result, it takes more electricity to remove this heat and to cool the equipment.

Faced with these factors, many data center managers are focusing on alternatives to reduce the cost of electricity.

Efficiency is the key!

How high or low is the priority of increasing the efficiency of your data center's energy use?

Critical priority,
15.5%

Not a priority,
4.7%

Low priority,
9.2%

High priority,
41.6%

Moderate priority,
29.0%

The majority of data center managers surveyed rate energy efficiency as a priority, and more than half said it is either a high or critical priority.

Managers in the Asia-Pacific Japan (APJ) region felt the strongest about this. Compared with their counterparts in other regions, fewer managers (percentage-wise) considered energy efficiency a low priority or not a priority at all. In other words, relatively more APJ managers considered this important.

In contrast, more than twice as many U.S. managers did not consider energy efficiency a priority.

This disparity could be due to tighter budgets in APJ. While the average annual data center budget for all respondents was $54 million, APJ organizations averaged $40.4 million. With tighter budgets, there might be more incentive to rapidly adopt energy-efficient strategies to keep costs down.
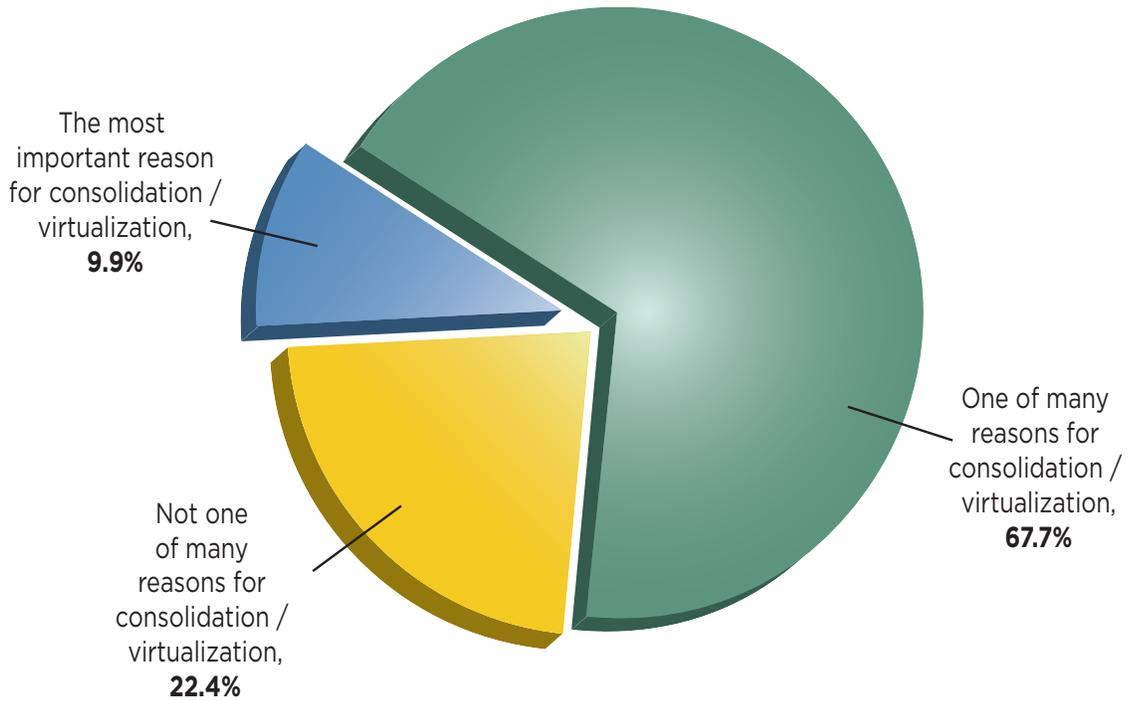
Implementing Strategies

The majority of data centers are already undertaking server consolidation and virtualization projects to reap the operational savings afforded by virtue of fewer physical devices to manage.

Among those managers who are implementing consolidation and virtualization efforts, more than three-quarters said energy consumption was a factor or the primary factor for doing so.

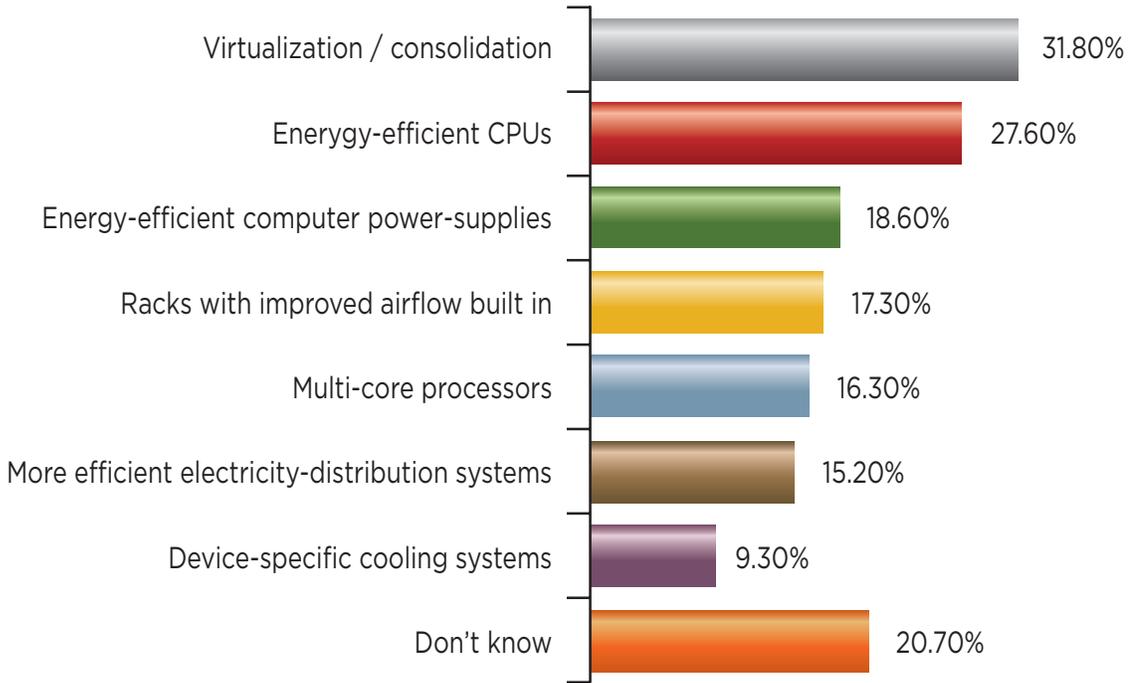### Energy consumption's role in consolidation/virtualization

What role did energy consumption play in your consolidation/virtualization efforts?

The most important reason for consolidation / virtualization, **9.9%**

One of many reasons for consolidation / virtualization, **67.7%**

Not one of many reasons for consolidation / virtualization, **22.4%**

In fact, consolidation/virtualization is considered one of the two most important technologies in reining in energy consumption. After consolidation/virtualization, other technologies that ranked high include energy-efficient CPUs and energy-efficient server and storage device power supplies.

Key technologies emerge

Which two technologies contribute the most to reducing power consumption in your data center?

Technology	Percentage
Virtualization / consolidation	31.80%
Enerygy-efficient CPUs	27.60%
Energy-efficient computer power-supplies	18.60%
Racks with improved airflow built in	17.30%
Multi-core processors	16.30%
More efficient electricity-distribution systems	15.20%
Device-specific cooling systems	9.30%
Don't know	20.70%

To these latter points, about one-third of the managers surveyed said a product's energy efficiency is a very important factor when buying equipment. A bit more than another third said it is somewhat important.

Energy efficiency as a factor in vendor selection

What role does energy efficiency play in vendor selection when you are evaluating data center products?

Number one factor,
2%

Not a factor at all,
10%

Very minor factor,
16%

Very important,
**35%**

Somewhat important,
37%
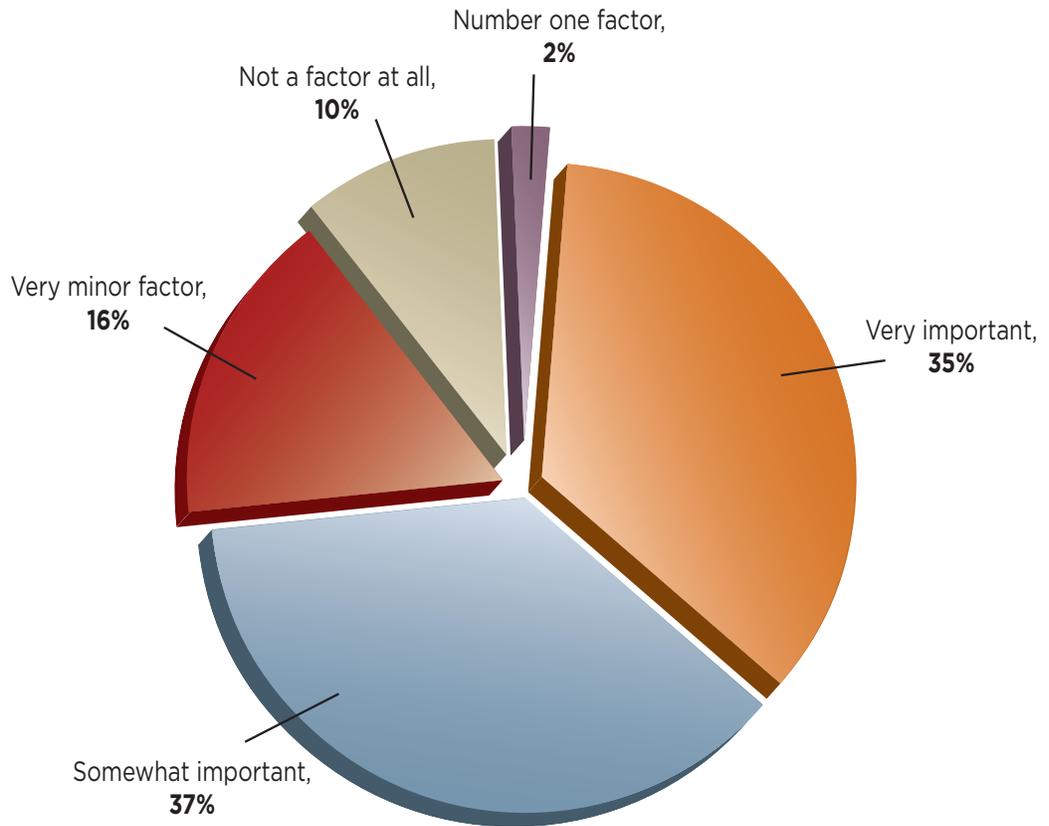
Another approach being used to improve energy efficiency is a rearrangement of the data center floor space. Traditionally, data centers have placed equipment racks all facing in one direction. But over the last few years, many data centers have adopted an approach in which adjacent rows have the equipment facing each other front-to-front (cold aisles) and the next row has equipment back-to-back (hot aisles).

This "hot aisle/cold aisle" approach allows a more concentrated strategy of cooling and heat removal applied specifically to the hot rows.

Data center architecture

Which layout do you use?

Other,
11%

Hot aisle / cold aisle,
37%

Racks facing a variety
of directions,
23%

Racks facing one way,
29%
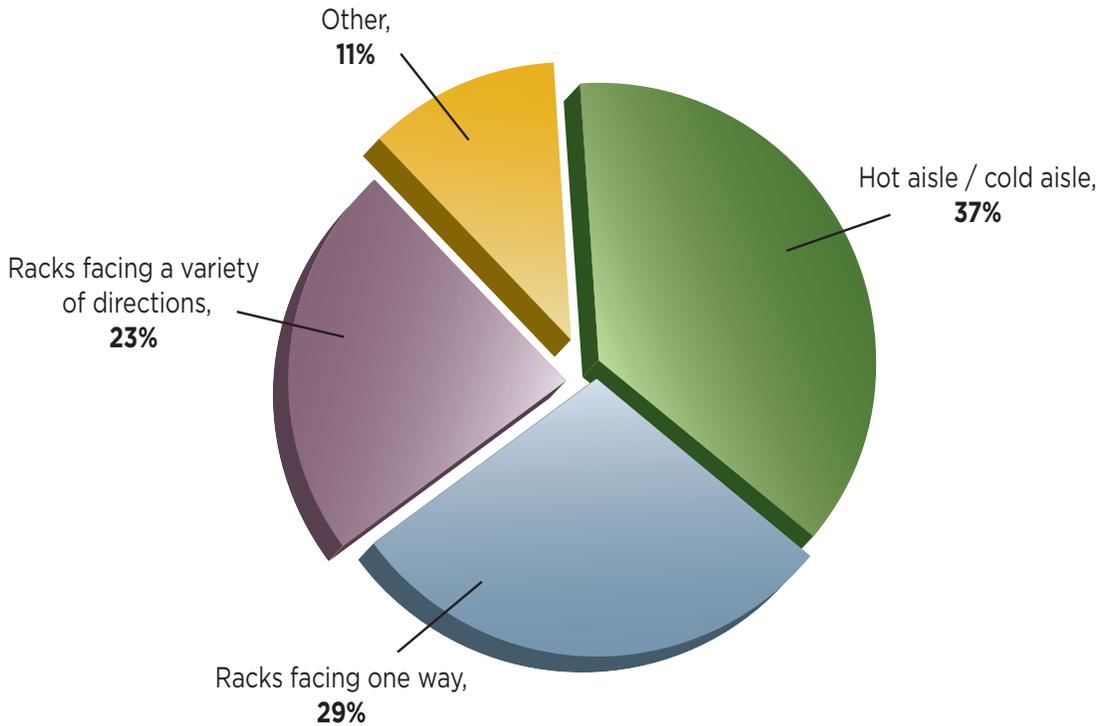
The survey found that the "hot aisle/cold aisle" approach is taking hold. It is now the most common approach to laying out a data center. Considering that until recently, most data centers either lined all equipment up in one direction (or didn't have a specific plan at all), this is a significant change in data center architecture. And it is all due to the growing heat issue in data centers and the rising cost of electricity to cool a data center.

Other Factors to Consider

From the focus groups, one point was made clear: Even when there is corporate pressure to reduce power consumption, business managers are unwilling to compromise on service levels.

In fact, the Symantec 2007 State of the Data Center study, done in conjunction with this Green Data Center study, found that more than half of the data center managers surveyed said internal service-level-agreement demands are increasing and are getting harder to meet.

In several focus groups, the managers repeatedly said that they are being pulled in two ways. There is direction, often from upper-level corporate management and boards, to reduce electrical use. But business managers are not willing to compromise on performance. Consolidation and virtualization allow companies to become more energy efficient without compromising performance.

Some managers are adopting energy efficiency out of necessity. Several focus group managers in congested urban areas, particularly New York, noted that their data centers have run out of electrical capacity. Some data centers are so constrained, they must be relocated outside the city. And some managers are trying to squeeze more lifetime out of existing data centers by using energy conservation techniques.

However, besides the pure operational and cost-saving necessity of becoming more energy efficient, there is another factor coming into play that is impacting data centers: the move to green data centers.

Enter the Green Data Center

Many organizations are adopting corporate social responsibility positions that frequently rely on what is called "a triple bottom line" that adds environmental and social concerns to the traditional economic measure of success.

As part of the environmental bottom line, some organizations have set up green initiatives that include a wide variety of elements. For instance, some plans include reduction of a company's power consumption and carbon footprint, while other efforts focus on recycling, reducing the burden on landfills, and addressing issues related to the disposal of toxic materials.

Activities in these areas are typically broad-based corporate initiatives, and most are not specific to the data center. However, because data centers are such heavy consumers of electricity — and some components of its equipment, such as batteries and metallic oxides used on motherboards, need special care at the end of their lifecycle — these broad corporate green initiatives are starting to exert some influence over data center decisions.

This influence is causing green initiatives to be *slowly* embraced or adopted. The survey revealed that only 49 percent of respondents are aware of a green policy adopted by their company, and only one in seven has implemented or begun implementing a green data center.

Perhaps one reason for the low uptake is the confusion about what the "green data center" actually is. This was evident in the focus groups, teleconferences, and interviews. One participant in Canada thought a green data center pertained to recycling paper. Another in Tokyo said he didn't understand what the moderator was referring to. Similarly, a manager in India noted, "I am not aware of the green data center concept." And one manager in London said he was familiar with the term, but it didn't "come into my day-to-day thinking to be honest."

Yet, even with so much confusion globally about what a green data center is, about half of the managers surveyed said they were discussing, planning, or already implementing a green data center.

For many managers, it is a personal matter. More than half of the managers said they will either advocate or plan to advocate green policies for their firm to adopt. Still, while the subject matter as a whole is not being met with a sense of urgency, the issues associated with a green data center are critically important for data center managers.

For instance, energy efficiency and reduction of power consumption are naturally relevant to any green data center strategy, since the data center is the largest consumer of electricity in many organizations.

However, in some cases the other aspects of corporate social responsibility are now starting to have some impact on data centers.

For example, many companies have paper recycling programs that previously had nothing specific to do with the data center. But now, these policies are expanding to other areas to include the recycling of computer equipment and the prevention of toxins being improperly disposed of in landfills.

Some companies are setting policies on their own to be good corporate citizens. Others are being forced into adopting such policies by local mandates and government laws.

This is causing some companies to purchase data center products that can be recycled in such a way that materials such as heavy metals are separated and reused, rather than being discarded in landfills. As such, about a third of the managers surveyed said reducing the use of toxic materials is a high or critical priority.

Additionally, many organizations have instituted waste-handling and management programs to comply with local recycling and disposal laws. Many of these efforts are not specifically data center-centric and are quite broad, covering such issues as the disposal of paper, chemicals, and toxic elements. However, these mandates are increasingly being extended to data center equipment, too.

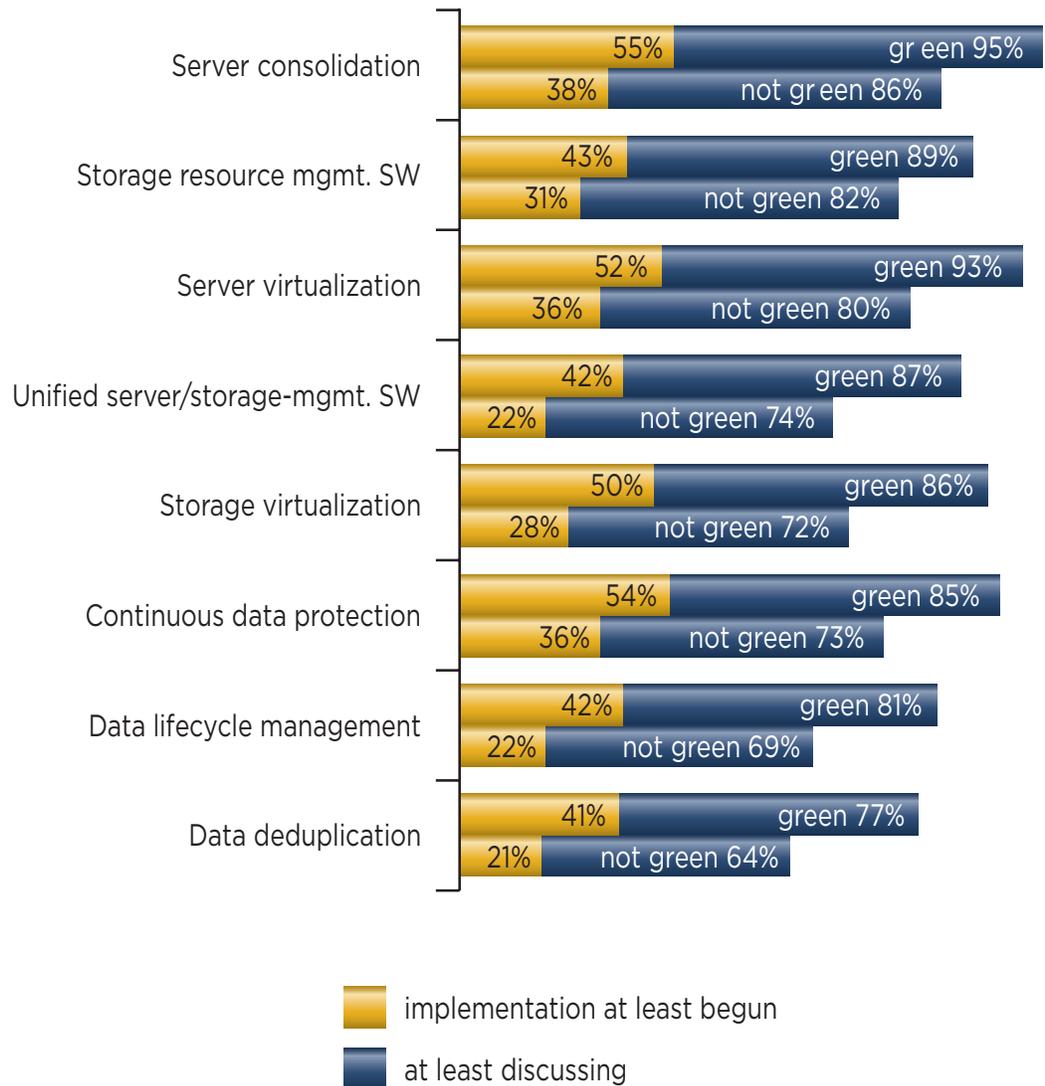## Software Plays an Increasing Role in Turning Green

Organizations that are at least in the trial stage of a green data center initiative are more likely to be implementing — or discussing — the use of a number of sophisticated technologies that can save energy.

When comparing those companies that have gone green to those that have not, more of those that are green are at least discussing the use of technologies such as server consolidation/virtualization and better storage and server management.

At the discussion level, there is only a small difference in the use of the various technologies between green and non-green organizations. However, when it comes to actually putting these technologies to work, companies with green data center initiatives under way are much more likely to be progressive and make use of these energy-saving approaches.

Green adopters' use of sophisticated technology solutions
Which best describes your data center's involvement with the following technologies?

Technology	implementation at least begun	at least discussing
Server consolidation	55%	green 95%
	38%	not green 86%
Storage resource mgmt. SW	43%	green 89%
	31%	not green 82%
Server virtualization	52%	green 93%
	36%	not green 80%
Unified server/storage-mgmt. SW	42%	green 87%
	22%	not green 74%
Storage virtualization	50%	green 86%
	28%	not green 72%
Continuous data protection	54%	green 85%
	36%	not green 73%
Data lifecycle management	42%	green 81%
	22%	not green 69%
Data deduplication	41%	green 77%
	21%	not green 64%

■ implementation at least begun

■ at least discussing

In particular, compared to those that are not going green or are in the early planning stages, enterprises that are trialing, implementing, or have already implemented a green data center are much more likely to be using software for virtualization, storage resource management, unified server/storage management, continuous data protection, data lifecycle management, and data deduplication.

For example, nearly twice as many green data center managers as their peers whose centers are not yet green have at least begun implementing data deduplication, data lifecycle management, and storage virtualization.

The implication of using any of these software technologies in a green context is that they drive up server and storage utilization rates, thus requiring fewer physical servers or storage devices. And fewer devices means the data center draws less electricity for power and cooling, which can result in cost savings.

Regional Differences in Strategies

To better understand the hows and whys of green data center decision-making, one need only look at the regional variations in drivers to 'go green.'

IT equipment's energy use

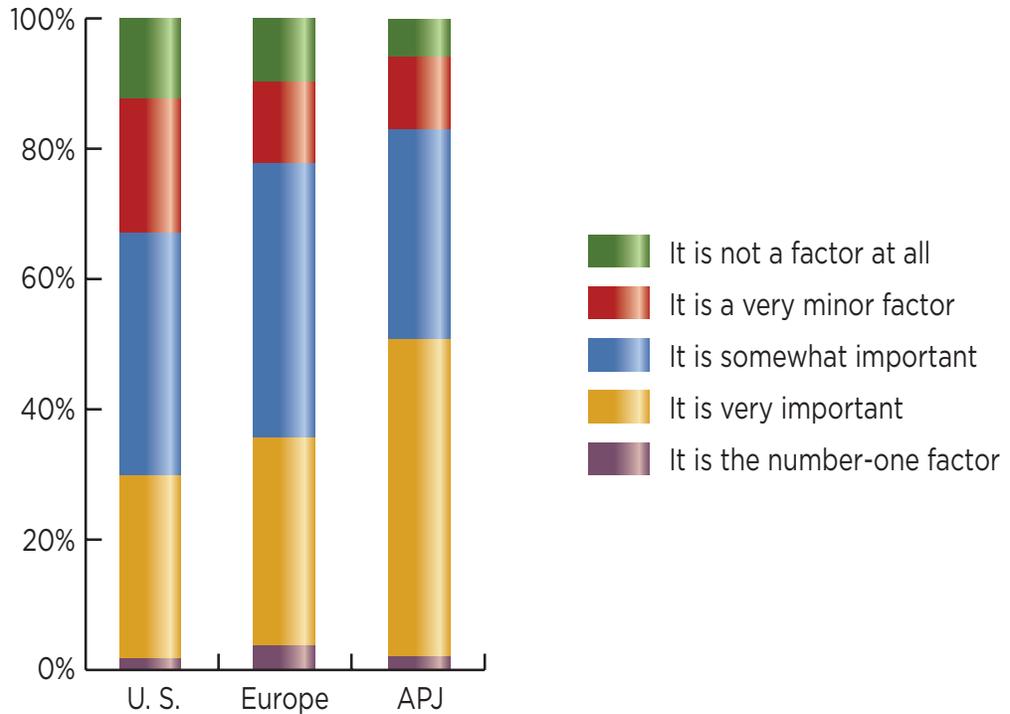What percent of your data center's total power consumption does its IT equipment consume?
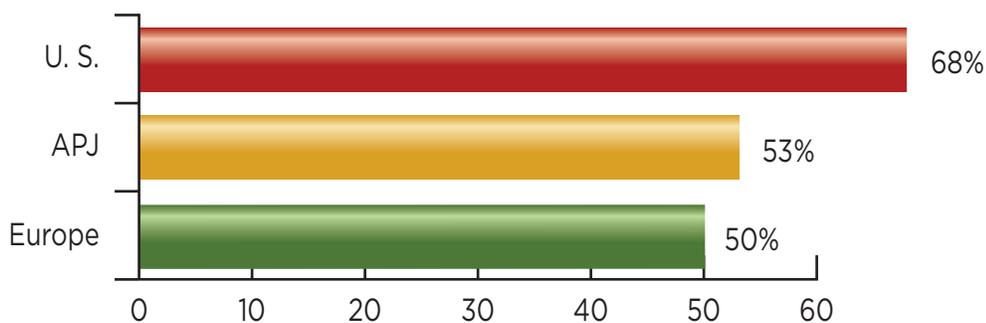
For example, IT equipment in U.S. companies consumes a significantly higher percent of the total electricity needed to run a data center than in the other regions. The reason for this is likely due to the fact that U.S. data centers have higher annual budgets ($71 million vs. $48 million for non-U.S. companies) and thus are more likely to have more and newer higher-performance servers and devices. And, until just recently, there was a direct correlation between the increased processing power of newer systems and increased energy consumption.

Processor manufacturers have addressed this problem with the introduction of more energy-efficient CPUs. And systems manufacturers have started incorporating more energy-efficient power supplies into some IT equipment. But these solutions help curb energy consumption only if companies look for these features and buy products that incorporate these technologies.

In the United States, that is not the case. U.S. data center managers who participated in the study are more likely than their counterparts around the world to ignore these power-saving features. Specifically, almost twice as many U.S. data center managers said energy efficiency is a very minor factor or not a factor at all when buying data center products.

Energy efficiency's role in purchasing decisions
How important is energy efficiency in your decision to buy a product?

Legend:
- It is not a factor at all
- It is a very minor factor
- It is somewhat important
- It is very important
- It is the number-one factor

There are several reasons why U.S. managers might not be as concerned about this matter.

For one thing, they simply may not be aware how much their company is spending on electricity.

Half of the U.S managers surveyed didn't know how much their company paid annually for electricity to run their data center. In contrast, less than one-third of APJ region mangers didn't know.

Similarly, U.S. managers were much less likely to measure the energy consumption of their installed servers. For example, only about 40 percent of U.S. managers measured power consumption at least once a month. But about 60 percent of APJ managers and 50 percent of European managers did so.

In addition, electricity is often less expensive in the United States compared with other regions of the world, so U.S. managers may not feel an urgent need to conserve. And, even within the United States, there are regional differences. In fact, within the last year, several organizations opened large data centers in the Pacific Northwest and Midwest, where the rate per kWh is one-fifth to one-half of the rate in urban areas in the Northeast and Western United States.

Such factors might also account for the need managers in some regions have to squeeze more power savings out of existing equipment. Compared to their U.S. counterparts, nearly twice as many APJ managers said they use power management solutions for their data center equipment. About a third of U.S. managers have no plans to use such equipment, whereas their European and APJ colleagues are more likely to be considering such tools.

Noting these regional variations on incentives and drivers, it is interesting to look at the role energy conservation played in implementing server consolidation/virtualization technology, the most commonly cited method to cut energy consumption in all regions of the world.

When it comes to server consolidation/virtualization, the Symantec 2007 State of the Data Center study found that in terms of actual implementations, U.S. companies are far ahead of their counterparts around the world. However, while there are fewer APJ organizations currently using consolidation/virtualization, more managers from this region cite energy-consumption reduction as the reason for doing so. In fact, while 72 percent of U.S. managers said energy-consumption reduction was considered the most important reason or one of many reasons in their decision to implement consolidation/virtualization, 88 percent of APJ managers said it was the case.

These trends were evident in the focus groups. Attendees in non-U.S. regions were more likely to mention reducing energy consumption as a factor in making the move, while it was clear that U.S. managers were aggressively adopting consolidation/virtualization for a number of reasons including simplifying management and reducing operational and energy costs.

Reducing energy consumption drives consolidation/virtualization
What role did reducing energy consumption play in your decision to implement server consolidation/
virtualization in your data center?

Legend:
- Not one of the reasons
- The most important reason
- One of many reasons
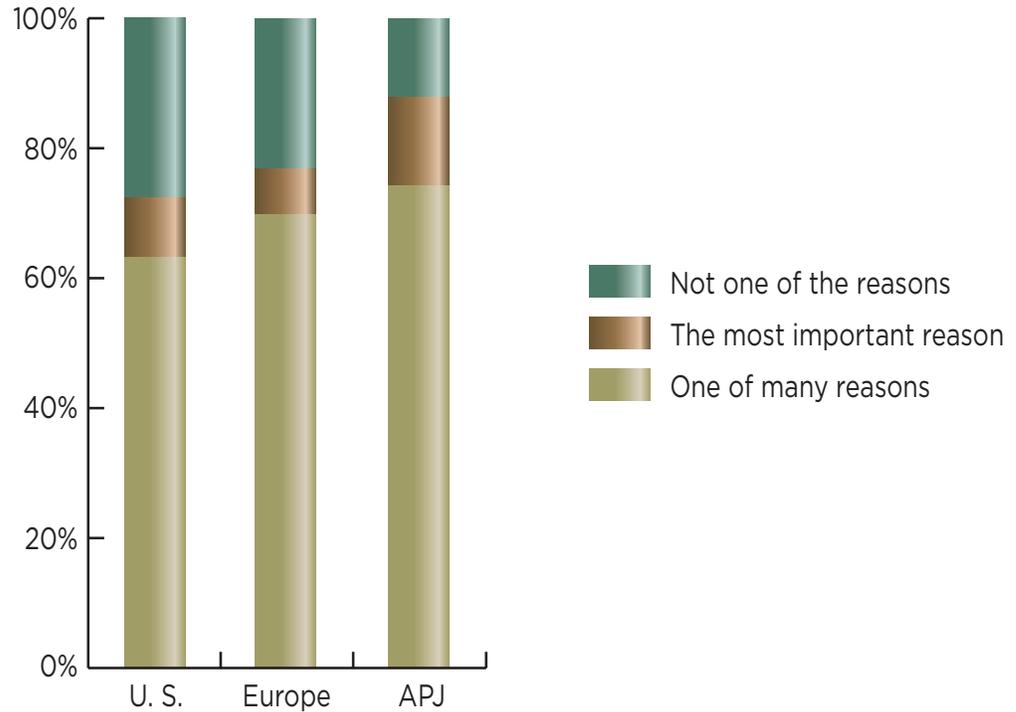
Broadening Definition Expands the Scope of 'Greenness'

In this study, discussions in focus groups, teleconferences, and one-on-one interviews revealed that
data center managers hold widely varying opinions as to what constitutes a 'green' data center.

Fortunately, more than two-thirds of the managers surveyed worldwide said they were familiar with
the concept.

The green data center becomes well-known

How familiar are you with the concept of the green data center?

Never heard of it,
8%

Not very familiar,
23%

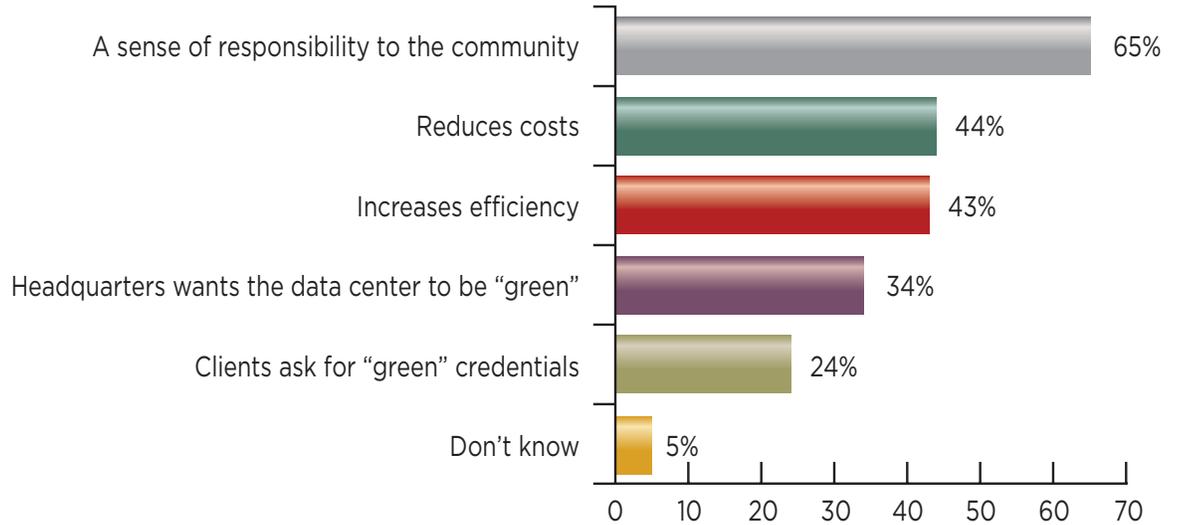Very familiar,
14%

Somewhat familiar,
55%
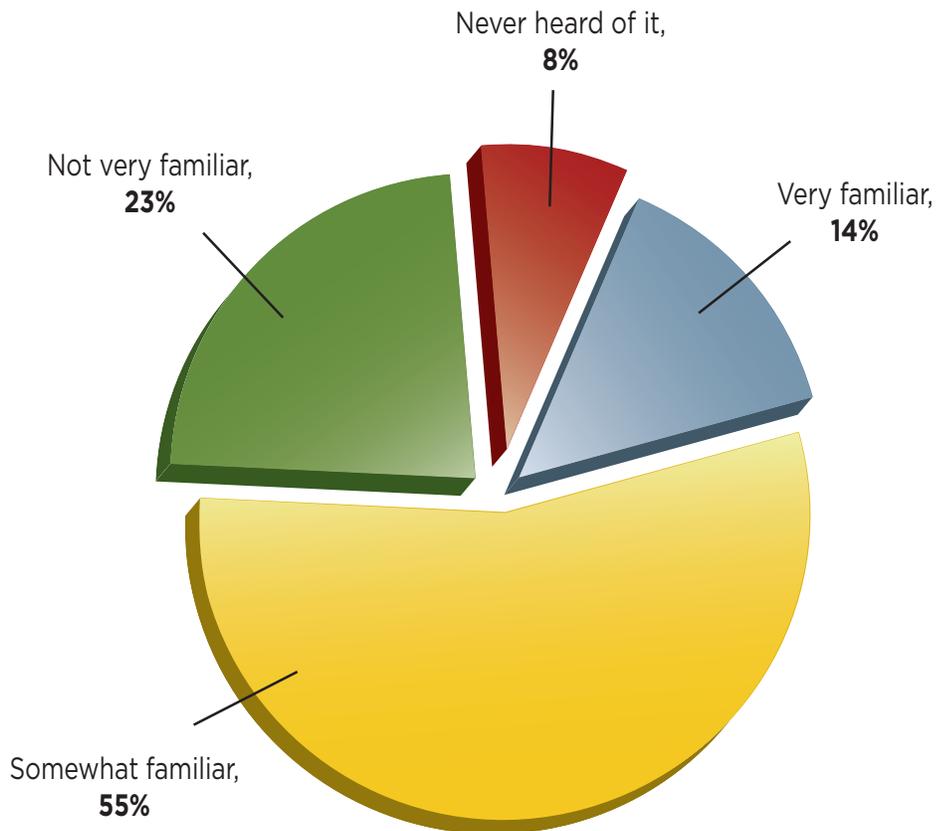
Most managers surveyed had a variety of reasons for embracing the green data center. Almost two-thirds said one reason was to be better corporate citizens in their community.

This factor was much more pronounced in the APJ region. Almost three-quarters of the managers there indicated that a sense of responsibility to the community was an important consideration.

Other reasons for going green included reducing costs and increasing efficiency. These were neck and neck after social responsibility.

Why go green?

What are the reasons you are creating, or considering creating, a green data center?

Reason	Percentage
A sense of responsibility to the community	65%
Reduces costs	44%
Increases efficiency	43%
Headquarters wants the data center to be "green"	34%
Clients ask for "green" credentials	24%
Don't know	5%

Many APJ and European managers checked only social responsibility as the reason, while more than half of the U.S. managers listed three or more reasons for creating a green data center. Many more U.S. managers indicated that reducing costs was the reason to go green in the data center.

This high response rate might be due to the fact that many U.S. companies do not yet have green policies. In fact, only slightly more than a third of U.S. companies said they have green policies, while almost 60 percent of APJ and 55 percent of European companies have them.

APJ and Europe have been ahead of the United States when it comes to conserving energy. They typically have used more energy-efficient cars, and many of their buildings have energy-saving features — such as light fixtures in public areas that automatically shut off in a set period of time — as the norm.

Not surprisingly, more APJ and European companies than their U.S. counterparts plan to use alternative energy sources, such as solar energy, to help support their green data center initiatives.

Another factor that plays a role in adopting a green data center strategy is that a growing number of companies are now mandating green policies throughout the organization. This is more prevalent in APJ and European companies, many of which consider reducing the use of polluting energy sources and hazardous and toxic materials a moderate, high, or critical priority.
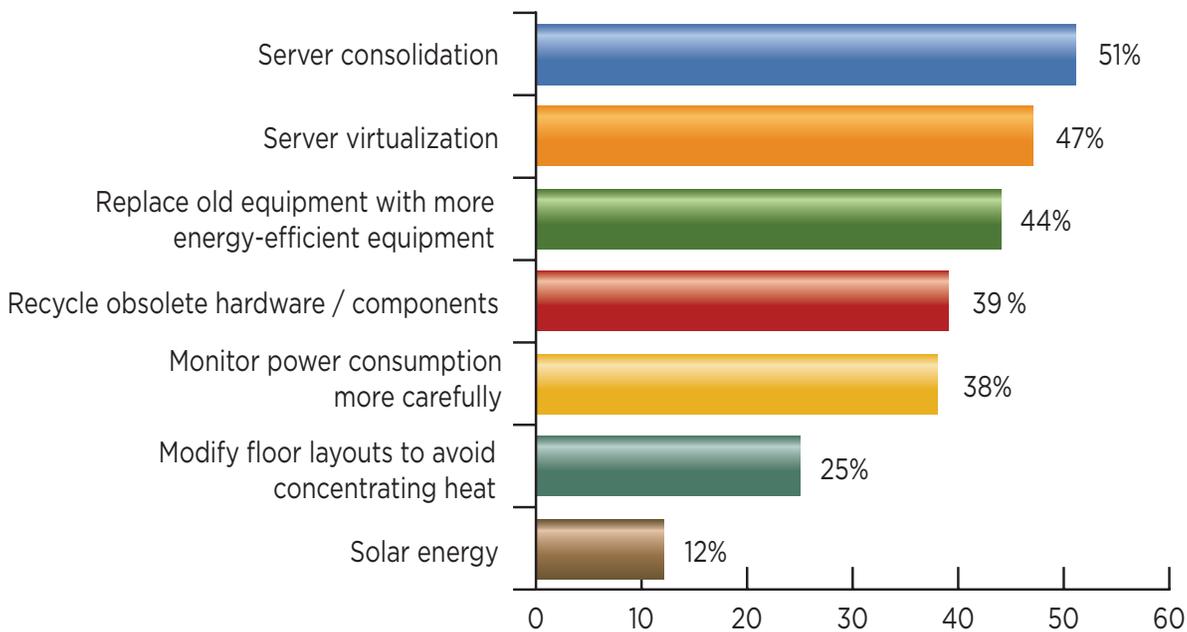
Moving Forward

Today, most companies are at least considering a green data center initiative. In fact, 71 percent are discussing, planning, testing, or implementing green data center strategies.

During the next 12 months, most organizations plan to incorporate new technology or undertake initiatives to support the greening of their data centers.

This year's plans
Which of the following are you implementing or planning to implement in the next 12 months?

Server consolidation	51%
Server virtualization	47%
Replace old equipment with more energy-efficient equipment	44%
Recycle obsolete hardware / components	39%
Monitor power consumption more carefully	38%
Modify floor layouts to avoid concentrating heat	25%
Solar energy	12%

Leading the way are server consolidation and virtualization efforts. Here, there are strong regional differences. About 60 percent of managers in the United States either have consolidation/virtualization moves under way or plan to within the next year. In contrast, only about 40 percent of APJ and European managers do.

As noted earlier in this report, the reason for this disparity might have to do with budgets. The U.S. companies typically have more to spend and perhaps could more easily afford to replace existing servers with higher-performance ones to support consolidation and virtualization. Conversely, compared to their U.S. counterparts, more than twice the number of APJ and European managers plan to use solar power to get energy for their data centers.

Managers are also looking at other techniques to improve the greenness of their data centers. For instance, some are planning to use heat pumps to shift the distribution of heat in their data center so that they may more efficiently remove it or cool it.

Taken together, the planned adoption of all these technologies and strategies point to one conclusion: The data center will become greener over the next few years. The reasons vary widely, from social responsibility and pressure from clients to reducing the cost of electricity. Regardless of the reasons, the next 12 months will be a pivotal period in the transformation of the current data center into the greener data center of the future.

About Symantec

Symantec is a global leader in infrastructure software, enabling businesses and consumers to have confidence in a connected world.

The company helps customers protect their infrastructure, information, and interactions by delivering software and services that address risks to security, availability, compliance, and performance.

Headquartered in Cupertino, Calif., Symantec has operations in 40 countries.

More information is available at www.symantec.com.