



Cutting Costs with Greener IT



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Greenhouse gas emissions aren't necessarily the first thing that comes to mind in a typical data center. With its almost sterile climate-controlled interiors and the absence of chemical discharges or smoke, the data center might seem at first glance to be perfectly eco-friendly.

Until, that is, one considers the massive amounts of electrical power that data centers and other information technology (IT) assets consume. According to one estimate, the typical data center uses as much power as 25,000 homes. Meanwhile, the global emissions attributable to information and communications technologies, including data centers, computers, mobile phones, computing, and telecommunications networks, is about 0.86 gigatons annually, or nearly 2% of all emissions, according to a 2008 McKinsey & Co. analysis.

And the fastest-growing contributor to those emissions will be data centers, whose carbon footprint is projected to rise fivefold between 2002 and 2020, according to the McKinsey analysis. The electricity to feed the IT demand, of course, comes from generating stations that produce varying levels of emissions, depending on their fuel type, making IT a significant contributor to global warming, albeit indirectly.

The environmental challenge of such massive power consumption, however, offers a huge opportunity to cut costs. This article will explore the increasing demands that organizations face today in meeting the energy needs of their IT assets. Experts from Wharton and Wipro Technologies will discuss “green IT” solutions that offer the potential to dramatically cut energy expenses, and carbon and other greenhouse gas emissions.

There was a time when a chief information officer could blithely ignore that IT rang up the highest electricity bill of any department, or that the need for new hardware kept growing — “server sprawl” — to keep pace with operational demands. For years, expanding the data center was a nearly unquestioned requirement to keep pace with business

growth. But the rapid rise in the last decade in the number of data centers, and the amount of energy they consume, makes that growth-at-any-cost attitude unsustainable.

The Green IT Opportunity

Businesses, government, academia and others are under increasing pressure to take serious measure of their carbon footprints. More consumers than ever make purchasing decisions with environmental considerations in mind. Boards of directors, anticipating regulatory changes, demand that companies cut energy consumption, emissions or both. And 68% of IT executives polled by the market research firm IDC in 2009 rated energy efficiency a “top of mind” priority with regard to green IT.

The good news is that IT lies at the epicenter of tremendous opportunity for energy-related cost savings. For example, some studies suggest that virtualization, a technology for managing IT hardware and software can reduce a data center's electricity bill for servers by 80% — mostly because it requires considerably fewer servers. Ancillary benefits include larger budgets for value-added projects and smaller physical space requirements, made possible through a transition to green IT.

The term “green IT” can cover a bewildering array of domains and devices including data centers, desktop and mobile computing stations and monitors, networks, IP-based communications systems, and HVAC systems used to keep equipment running cool. Where does one begin to address these components in a way that is holistic, realistic and appropriate for the organization's needs?



A key step before diving into any remediation plan is to perform a thorough assessment. The tools for assessing enterprise-level green practices have evolved from do-it-yourself Excel spreadsheets to elaborate carbon accounting software suites available on a subscription basis. By first determining a baseline, organizations can set clear goals for adopting greener IT practices. Potential solutions include virtualization, IT-aided energy conservation and even use of renewable resources to bring an IT operation closer to carbon-neutral emissions status.

But given the significant capital investment that data centers represent, with some of the largest costing as much as \$1 billion, a rigorous measurement of the carbon footprint and energy consumption is the best way to maximize any spending on equipment upgrades or software-as-a-service. In the last few years, software companies have removed some of the drudgery from this process with programs that handle much of the routine information-gathering.

“The earlier tools were primarily Excel spreadsheets. The amount of data you had to collect and collate was too tedious,” says Hari Kishan Burle, practice head of Business Solutions & Architecture at Wipro. Now many companies offer carbon accounting software to help firms identify which activities generate the most greenhouse gases.

While software features may vary, with customization for different industries, they tend to be based on a common set of procedures called the Greenhouse Gas Protocol, the most widely acknowledged international accounting method for inventorying organizational greenhouse gas emissions. The World Resources Institute, an environmental think tank, and the World Business Council for Sustainable Development, a coalition of 200 businesses, came up with the protocol in 1998. (The Business Council draws its membership from more than 35 countries. Its U.S.-based members include 3M, Boeing, General Motors and Oracle.) Since its inception, the Greenhouse Gas Protocol has become a template for companies that want to account for their greenhouse gas emissions.

Specialized software can speed up the reporting process, which Burle likens to the Sarbanes-Oxley accounting rules in the United States in terms of complexity and detail.

A Wipro software offering, for instance, gives companies the ability to recalculate their emissions after mergers or acquisitions and also to compare emissions-reduction goals to actual performance. This “Carbon Management Solution” software for enterprises uses a software-as-a-service subscription model that’s become standard for Web-based reporting and analytics tools.

Software can allow entire organizations, not just IT shops, to understand the sources of their emissions, to prepare reports for registries maintained by the U.S. Environmental Protection Agency (EPA) and other agencies, and to view performance “dashboards” of emissions across the enterprise. Software-makers envision a time when companies can use such tools to aid with compliance or even to make money through proposed carbon exchange markets.

An Integrated Approach

“Before even quantifying the savings, we have to be able to have a mechanism with which to measure,” says Burle. He and other Wipro experts recommend that those interested in “greening” their data centers take a comprehensive, integrated approach that considers all elements from assessment to implementation.

According to Wipro, the key steps in a comprehensive plan should include a strategy and assessment effort, which would involve site and equipment analysis, and creation of a “quick-win” road map. Quick wins generally are easy-to-achieve cost-cutting moves such as putting programming monitors to “sleep” after a predetermined period of inactivity.

An analysis by the Wharton Computing Brainstorm blog, for instance, showed that the school would save \$8,300 annually just by changing monitor settings to enter “sleep” mode after one hour of inactivity on 500 public computers. That would also avoid the annual production of 122,000 pounds of carbon emissions.

A comprehensive plan should also include return-on-investment modeling, to give an accurate idea of the value of any savings. In one consultation with a major Indian telecom provider, Wipro says it eventually saved the client 30 million rupees (about \$620,000).



According to Wipro experts, following the assessment phase, companies should formulate their green policies, develop procedures and metrics, and plan for organizational alignment. Implementation can be divided into IT-based solutions (virtualization and consolidation, data center design and architecture) and solutions not directly IT-related, such as data center power and cooling, and power management.

“There are two ways of starting, two drivers,” says I. Vijaya Kumar, Wipro’s chief technology officer. “One is, ‘Can you do it faster?’ The other is, ‘Can you do it at less cost?’”

In the software-as-a-service industry, “We see energy management as more of a driver than waste management,” Kumar adds. “We also deal with customers’ sustainability goals,” addressing details as specific as managing air flow in data centers.

While greening the data center offers one of the most obvious areas for reducing IT-related expenses, Wipro experts are exploring a range of information and communication technologies for squeezing out incremental savings. For example, the company takes advantage of, Web-based meeting and phone software in lieu of travel, and it cites the benefits of dematerialization — moving away from physical storage including paper, packaging and even CDs.

Examples abound of companies that have boosted the bottom line by pursuing IT efficiency in the margins. For example, Nortel, the telecommunications firm, had more than 150,000 square feet of raised floor space in 2003 to accommodate its servers. But by the end of 2009, the company says, it will operate with less than half that amount, saving millions of dollars in real estate, air-conditioning, and uninterruptible power supply costs.

And Nortel estimates it will use 15 million kilowatt hours less electricity, resulting in an annual savings of about \$530,000.

Potential Rewards and Challenges

To be sure, implementing greener IT practices poses challenges.

Take, for instance, the increasingly popular practice of virtualization. This broad term refers to the replacement of physical computing assets with software that mimics

those assets and operating environments at substantially lower cost. Virtualization allows a Mac-equipped designer, for example, to run Windows business applications easily; it lets IT administrators place multiple virtual servers on one physical server box, thereby saving floor space, energy and maintenance costs. Some estimates suggest that virtualization can reduce direct hardware and energy costs by up to 80%.

But virtualization isn’t without drawbacks. Even virtual machines and applications require maintenance, including critical security patches and functionality updates. And the tendency of virtual servers, users and applications to proliferate often makes them difficult for administrators to track without proper systems in place. Also, the relative ease of provisioning virtual resources often leads to the creation of many more items to monitor within the network than existed previously. Physical server sprawl is often replaced by virtual network sprawl. So when it comes time to hunt down system-related problems, the IT administrator’s job can be magnified unless the whole process is well-managed. Still, gains are available for those willing to take a comprehensive approach.

“It’s fantastic when it works,” says Deirdre Woods, chief information officer at Wharton. Wharton recently upgraded to a green data center that Woods describes as “highly virtualized.” She adds, though, that the ability to afford talent well-versed in the technology could pose a significant barrier for some organizations, at least for now. “You need really smart people to run this stuff, and not every business can afford super-smart people.”

Of a less technical nature, organizations may have to work to obtain employee buy-in to reap the benefits of some simpler green-IT solutions. For instance, if it’s customary to leave machines, monitors or lighting on after hours and weekends, employees will have to be conditioned to adopt more eco-friendly behaviors.

Burle says that at Wipro, during one in-house assessment, “We realized the energy we were using on weekends was the same as what we used on weekdays,” simply because it was not yet in the company culture to turn off machines, equipment and especially servers when they would be idle for lengthy periods.



Broadly speaking, IT managers from the CIO on down will have to be more conscientious about resource planning and held more accountable for variables that cumulatively add to the cost (and carbon footprint) of their IT operations if the organization sincerely wants to reduce its environmental impact.

Some of the most productive steps to decrease data centers' carbon footprints include the following:

- Provisioning servers realistically, as opposed to building for peak resource usage that rarely occurs. IDC estimates that average server usage hovers between 5% and 15%.
- Including energy efficiency and maximized space utilization in the criteria when siting data centers.
- Choosing software platforms with the entire organization in mind, rather than making IT decisions in a silo.
- Considering the carbon footprint ripple effects before buying a server simply for a lower price tag.

And then there's the question of what to do with an organization's obsolete equipment. Despite IT managers' best intentions, "e-waste" often winds up in the poorest areas of developing nations, where workers (and their environment) are exposed to toxic fumes and substances while stripping devices for reusable material. Woods says better life-cycle management of IT equipment by manufacturers is needed before they can truly market their wares as "green."

"I think what's not looked at are real cradle-to-grave costs." In the United States, at least, "end-of-life" hardware issues continue to plague businesses. There's not much out there for disposing of "your old stuff," Woods points out.

To address e-waste, Wharton provides "Technotrash Cans" for students, faculty and staff for disposal of CDs, cell phones, PDAs, cables and laptops, all which could leak hazardous materials if sent to a landfill. Instead, a commercial electronics recycling firm disposes of the waste responsibly for a weight-based fee.

Compliance, Cost Savings

On balance, embracing more environmentally sustainable IT practices demonstrates a sense of corporate social

responsibility and a commitment to the organization's long-term interests. Worldwide, national and regional standards are being drawn up to more tightly regulate not just direct emissions sources — motor vehicles and power plants — but also major energy users that indirectly contribute to greenhouse gas production.

In the U. S., where carbon regulation has historically met strong political resistance, Congress was debating whether to pass historic carbon-controlling legislation in the fall of 2009. Meanwhile, the EPA was prepared to declare carbon dioxide and five other greenhouse gas emissions as dangerous pollutants. If the EPA were to adopt its so-called endangerment finding, it could impose federal carbon regulations under the existing Clean Air Act, regardless of whether Congress passed a law.

For corporate counsel, greener IT offers a way to get ahead of pending regulation — before fines or other costs of inaction can affect the company. But Wipro's Burle says taking action has a more immediate financial benefit — rooting out profit-robbing wastefulness.

"Companies will initially do it for compliance," says Burle. "But a higher carbon footprint means inefficiencies." Where enterprises can identify and streamline those inefficient processes, opportunities exist to increase profitability.

Google, for instance, says that by implementing green IT practices, its data centers — the heart of its operations — consume about half the electricity of a typical data center. The servers that inhabit data centers present many points for potential waste: the engineering of internal power consumption systems, the need for cooling and the loss that occurs in necessary power conversion.

But Google claims that by optimizing these and other elements, it's able to save \$30 per year per server on costs associated with carbon dioxide emissions, water consumption and electricity. While \$30 might not sound like much, when multiplied by the company's estimated several hundred thousand servers, it becomes a material savings.

Non-IT solutions for greening IT merit attention too. Michael Tomczyk, managing director of the Mack Center for Technological Innovation at Wharton, notes that innovative ideas are emerging around making data centers greener.



“For example, there are data centers being constructed underground or in hillsides to take advantage of the natural cooling effects, since maintaining the temperature range in a data center is one of the largest power uses,” Tomczyk says. “California has a ‘Million Solar Rooftops’ initiative. The entire California office complex at Google — one of the largest IT operations in the world — is covered with solar rooftops.”

“One day there will be a requirement that all new buildings will have to be carbon-neutral, at least in industrialized nations,” says Tomczyk. In other words, buildings will have to counterbalance their direct and indirect emissions either through the purchase of offsets or by producing clean, renewable energy on-site with wind, solar or other technologies.

“These will require sophisticated information systems to control, monitor, regulate and especially to track the savings using both economic and environmental metrics,” Tomczyk says. “The current global movement to sustainable design for buildings and communities is moving us in the direction of carbon neutrality, but I believe it will take a decade or more to muster the right combination of political will, technological capabilities and economic formulas to make this happen on a meaningful scale.”

An Inevitable Transition

Obviously, any organization considering projects as ambitious as a green data center or enterprise-wide carbon footprint assessment needs to do its homework. Are the vendors likely to be around in a year or so when support is needed? What kind of reputation does the product have, and is it used by others in your industry or sector? Do the numbers add up for return on investment, total cost of ownership and other important decision-making metrics, and are they plausible?

Woods sees the migration of data centers to green technologies as more or less inevitable. “People’s life expectancies for servers are three years, and maybe you can eke out five or six.” Each generation of equipment becomes more energy efficient, making it “easy to do the right

thing,” Woods notes. “There’s a cost perspective. There’s an opportunity cost perspective — we can do more stuff because we’re consuming less energy. There’s economic benefit for us.”

Given the accelerated rate of obsolescence for IT equipment, and the real energy savings possible with newer equipment and technologies, IT leaders are increasingly moving to take advantage of the opportunities.

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