

# Green IT: Immediate Issues for Users to Focus On

Gartner RAS Core Research Note G00159605, Rakesh Kumar, 7 August 2008, RA4 04162009

Many IT users are confused about the relevance and maturity of green IT technologies, services and legislation. This research presents an analysis of what users should focus on in the short term.

## Key Findings

- More than 70% of Global 1000 enterprises will face significant data center problems, such as limited power and floor space, during the next four years, requiring substantial capital costs to build new facilities or refurbish existing ones. Without such investments, these organizations will struggle to provide adequate and efficient IT services.
- Market “greenwash” (hype, exaggeration of the problems and the positioning of inappropriate technologies) by vendors will continue in this rapidly changing segment of the industry.
- The immediate focus of green IT spending should be around data center power, cooling and facilities problems.

## Recommendations

- Measure, model and display appropriate data center energy information to manage operational costs and plan for future changes.
- During the next two or more years, select core IT hardware (servers, storage and networking equipment) based on its energy characteristics, as well as on traditional IT metrics (such as price/performance).
- Deploy a data center cooling strategy that combines free air, air conditioning and chilled fluid-based systems depending on the thermal profile of the IT equipment and the weather conditions in the data center’s location.

## STRATEGIC PLANNING ASSUMPTION(S)

More than 70% of Global 1000 enterprises will face significant data center problems, such as limited power and floor space, during the next four years, requiring substantial capital costs to build new facilities or refurbish existing ones. Without such investments, these organizations will struggle to provide adequate and efficient IT services.

## ANALYSIS

Green IT has become a “used and abused” term to incorporate a large number of technologies and programs during the past two years. Many vendors believe that by associating their products or services with this important aspect of the emerging technology spectrum, they will sell more products. However, there is a lot of confusion about what the actual green IT issues are, and about which products or services actually help to tackle user concerns.

Gartner's research shows that the spectrum of green technologies, services and legislation that users can focus on can be broken down into immediate, midterm and long-term activities (see Figure 1). This research focuses on the immediate time frame.

### Immediate Priorities

Gartner research has shown that the immediate green IT issues are around power, cooling and floor space problems in data centers and office environments. We believe, therefore, that user spending should focus on these areas. More than 70% of Global 1000 enterprises will face significant data center problems during the next four years, requiring substantial capital costs to build new facilities or refurbish existing ones. The Uptime Institute published a report in March 2008 stating that more than 40% of the organizations surveyed would run out of data center power in the next 24 months. With new data centers costing in the tens of millions of dollars, and running into the hundreds of millions of dollars for high-end Tier 4 sites, the sums involved are very large.

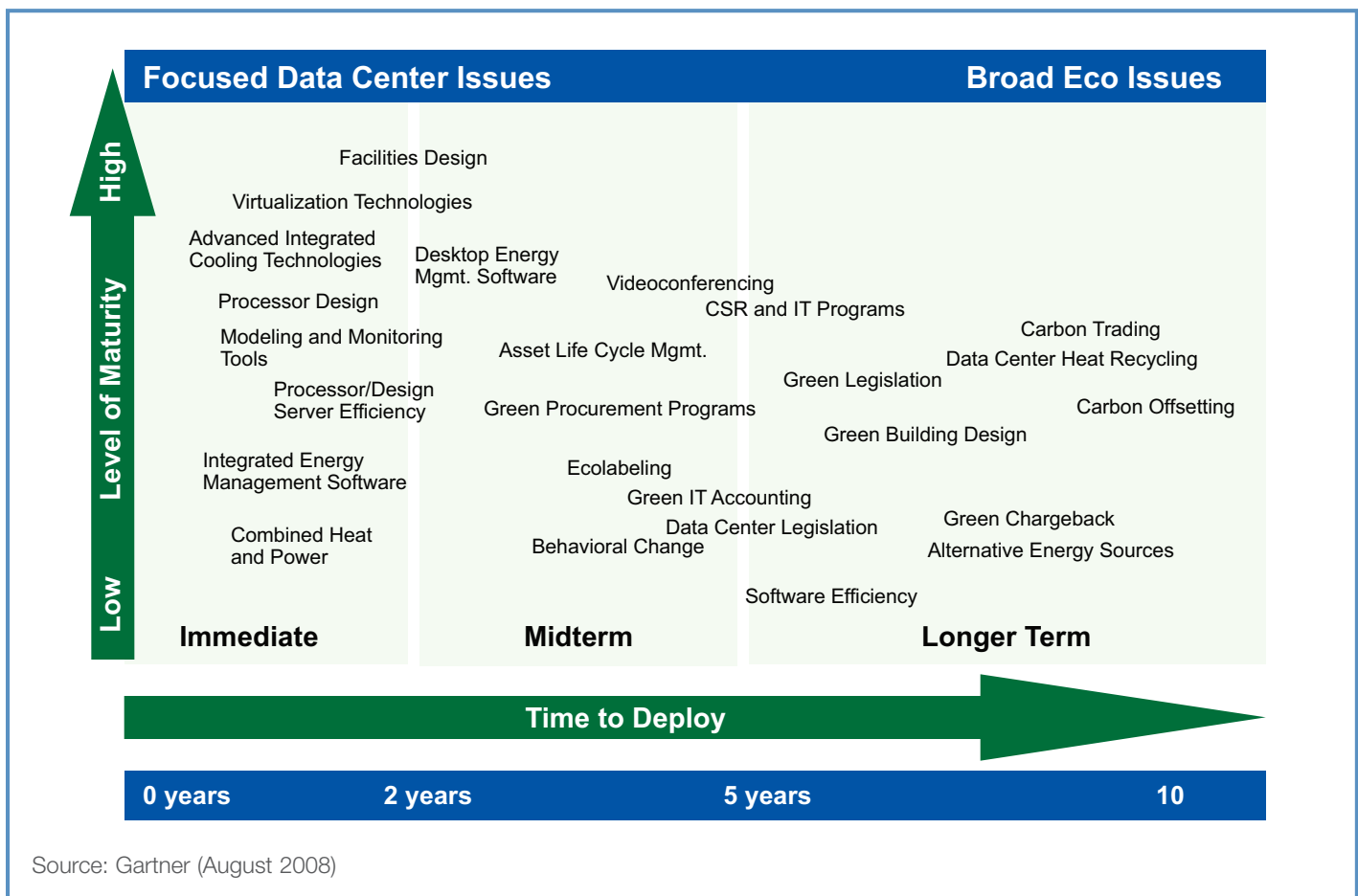
However, even more important is the fact that the new generation of data centers will be very different from existing ones. They will need to be flexible, modular and have an integrated software nervous system; they will need to behave like living organisms.

One other key area of concern is the use of energy in offices. This covers the energy consumption of computers, printers, and even the design and layout of the office. Energy use in desktops is much higher than it needs to be because of behavioral habits of users. People seldom switch machines off at night or during weekends.

### Modern Data Center Facility Design Concepts

Whether building a new data center or refurbishing an existing one, users need to deploy modern design characteristics. These are different from those that existed as little as five years ago. ("The Data Center as a Living Organism: Defining the Concept" covers the notion of a new data center as a living, breathing organism.) To

Figure 1. Green IT: Prioritizing the Issues



create such an entity, users need to build in a modular manner. In other words, rather than building a site that has the capacity for growth for, say, 20 years, it is more efficient in the long term to build a module that has a capacity for five years worth of growth. Once this module comes close to being fully occupied, then a second module should be built. This is the best way to minimize costs, manage a rapidly changing design envelope and future-proof as much as possible – given the variable nature of capacity growth and changing technologies. This means that, from a green IT perspective, new data centers designed in this way will not be overprovisioning their energy needs.

Users also need to design from the inside out. This means that they need to look at the thermal profile of their topology and design the energy distribution and cooling that is most appropriate to that particular hardware set up. For example, the energy and cooling needs of a mainframe system are very different to that of a rack of blades. Designing the power distribution and cooling to the maximum specification will result in overprovisioning and, therefore, a waste of energy.

**Tactical Recommendation:** Users designing new data centers must use modular design principles and map energy use to the characteristics of the IT hardware.

### Advanced Cooling Technologies

Data centers typically use as much energy on cooling their IT equipment as they do on powering it. Moreover, in certain cases, such as high-density and/or high-performance computing environments, they could use a lot more. Traditional computer room air conditioning systems (CRAC) use a large amount of energy and, in many cases, are proving to be suboptimal at cooling different types of equipment. Gartner recommends that users apply a mixed cooling approach, combining free air, air conditioning and liquid cooling. This means that outside “free” air should be used as much as possible given local climatic conditions. This is achieved in one of two ways:

- Filtering and dehumidifying the outside air and supplying it to computer room air handler (CRAH) units in place of recycled chilled air
- Using the outside air to absorb heat through a heat exchanger from higher-temperature water that is being returned to a chiller unit, thereby reducing or eliminating the load on the chiller

In most temperate climates, this will result in free air use for three to six months out of the year. Moreover, running data centers at around 24 degrees Celsius (75 degrees Fahrenheit), rather than the 18 degrees Celsius (64 degrees Fahrenheit) that has been typical, will also result in lower energy use. Users should check with their suppliers that the equipment is certified to be used at these temperatures, especially because outlet temperatures can rise rapidly. We also recommend using variable-speed fans for greater granularity.

There are some emerging technologies that users should evaluate cautiously. For example, the use of in-server cooling techniques, such as spraying a fluid onto the processor, may seem attractive, but it is not widely used. Also, the use of carbon dioxide gas

pumped across the rear of servers is used in a few instances around the world, but it carries maintenance and reliability problems.

**Tactical Recommendation:** Users should run their data centers at around 24 degrees Celsius (75 degrees Fahrenheit), having ensured that the equipment is certified to do so.

### Use of Modeling and Monitoring Software

One of the most important developments of green IT in data centers is the use of infrastructure modeling and monitoring tools. These are tools from vendors such as Aperture (Emerson), American Power Conversion (APC; part of Schneider Electric) and Global DataCenter Management, and they provide the capability to model the physical assets, energy use, available capacity, and thermal characteristics of IT components and facility components. From a green IT perspective, they allow energy optimization and the ability to plan more carefully for the energy-related consequences of infrastructure changes in the data center. Most of the products in this emerging category that Gartner is calling “physical resource and infrastructure management” are early in their life cycle and will mature during the next few years. However, even in their current state, they do offer benefits.

**Tactical Recommendation:** Users modifying their data centers or building new ones should use modeling and monitoring software tools to better manage energy consumption and space allocation.

### Virtualization Technologies for Server Consolidation

Virtualization technologies on all platforms can be used to improve the environmental footprint of data centers. Essentially, virtualization improves the use of servers. Most x86 servers are used at around the 10% mark on a daily basis, and the typical scenario is a new server for a new application. By running multiple applications on the same hardware box, this can be increased to around 50% or higher. This will result in fewer servers used, with the consequential benefits of less floor space needed, less transportation and recycling of those servers, and less manufacturing energy expended. From an energy use perspective, virtualization needs to be linked with consolidation and decommissioning. It's only by decommissioning servers that the significant energy savings are made.

**Tactical Recommendation:** Users need to start using virtualization technologies and decommissioning old hardware to save energy.

### Processor Design and Server Efficiency

Processor and server manufacturers are beginning to take a more-balanced view of new systems than ever before. In new design, the need to provide significantly improved compute performance over previous technology is still important, but it is now balanced with the energy and thermal implications of the increased compute power. Moreover, organizations such as HP and IBM are spending more resources in designing better server blowers and fans, as well as better electrical conversion and battery technologies. The problem for users is in doing a like-for-like energy or full life cycle green benchmark. With the introduction of the SPECpower benchmark about eight months ago, the relative energy

consumption for a standard workload can be compared. The U.S. Energy Star program will be rolled out to the server space, but it may take a few years.

**Tactical Recommendation:** Users need to select and deploy their next server systems based on their energy efficiency, as well as on the traditional price performance, availability and characteristics of the hardware.

### Energy Management for the Office Environment

Although data center energy use is a significant problem because of the concentrated effect of having a large number of servers in a relatively small area, Gartner research has shown that more than 30% of IT-related carbon dioxide emissions come from the use of PCs and monitors. Moreover, PCs tend to be used for only one-third of one day, but remain switched on for the whole day. This results in a considerable amount of energy being wasted in offices.

Newer systems tend to use less energy than older ones. For example, a modern desktop with a 19-inch liquid crystal display monitor would use about one-third of the energy of a 2004 system with a 17-inch cathode-ray tube monitor. Perhaps the biggest problem in the office environment has to do with human behavior. Providing incentives (positively or negatively) for people to become more conscious of their environmental responsibility tends to work in the short term, but needs constant reinforcement. Upgrading to newer systems will help. Windows typically has three power-saving modes: standby, hibernate and off. Moreover, software from companies such as 1E and Veridium can be used to provide additional power-saving functionality, such as providing on-screen use gauges that can be used to help in the reinforcement.

**Tactical Recommendation:** Users need to start using energy management software tools on their desktop environments to optimize energy use.

### Integrated Energy Management Software Environment

The ability to integrate a multitude of different energy management, modeling and workflow tools will become essential to running modern data centers in an optimized way. This will require the combination of building management systems, server management systems, facility management systems and enterprise consoles together to provide a single holistic view of the data center. In the future, such software may become linked to business process engines to automate change based on a business trigger.

Currently, the tools exist in a fragmented way, and sometime use different protocols. However, we recommend that any organization going through systemic data center changes should develop a road map for this integrated software suite and start deploying the tools, where possible. There are likely to be many areas of difficulties, but these should be clearly documented. Users could develop custom-made integration policies or wait for vendors to do some of the integration at the source.

**Tactical Recommendation:** Users need to accurately measure the electricity input into their data centers and the use of all major systems (servers, storage and facility components) by deploying meters and measurement tools.

### Combined Heat and Power

Combined heat and power (CHP), also known as cogeneration, is the simultaneous production of electricity and heat from a single fuel source, such as natural gas, biomass, biogas, coal, waste heat or oil. CHP is not a single technology, but an integrated energy system that can be modified depending on the needs of the energy end user. Using these systems in new data centers depends on location, the availability of a fuel source and the cost of equipment. The technology is not widely used in data centers today, but it will grow in importance during the next few years. In general terms, Gartner recommends using alternative energy sources as a key initial design criterion for all new data centers. Users should then eliminate technologies that are not sufficiently mature, or those that are too expensive.

**Tactical Recommendation:** Any organization designing a new data center during the next two years needs to factor in cogeneration as part of its base requirements for where the heat can be otherwise used, or where peak load-shedding requirements make it the most cost-effective path to compliance.

This research has identified some of the areas of the broad green IT spectrum of products and services that users should look at during the next two years. It has not prioritized the areas because the implementation of such programs will depend, to a large extent, on the propensity for implementing a green culture with the IT department and budgetary constraints. It will also depend on the state of other projects. For example, the need to look at CHP is essential if your organization is actively designing a new data center; but it is less critical for an organization that will not do so for a number of years.