

# A Green IT Approach to Data Center Efficiency

An IBM® Redbooks® Point-of-View publication by the IBM Academy of Technology



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## Highlights

Companies are facing energy constraints, increased data demands, and rising power costs. Implementing green strategies, such as a green data center, can provide a competitive edge while benefiting the environment for the following reasons:

- ▶ Energy efficiency is a growing part of business efficiency.
  - ▶ A green data center can meet growing data volume and increasing processing demand while managing escalating resource costs.
  - ▶ An efficient, green data center can help your company reduce costs and comply with legal and regulatory requirements.
  - ▶ Green initiatives benefit your brand image, increase positive public opinion, and improve your bottom line.
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## The need for a green data center

Human history is based on socio-economic models that used planet resources across borders and that, until recently, did not consider the effects of pollution and of depleting or using up resources. Now, because many resources are dwindling or finite, the cost of one of our most valuable assets, power, is soaring.

Energy costs are increasing worldwide. The availability of resources, such as oil, is unreliable. And power needs are being capped. The effect spans all aspects of energy consumption, but is especially critical with the rapid growth of data center needs. In a recent survey,<sup>1</sup> approximately 70 percent of data center owners cited that their number one concern was power and cooling.

In tandem with increasing energy costs, organizations are dramatically changing how they conduct business. Online collaboration has reduced travel. However, the resulting increase in collaborative operations and access is pressuring IT systems to provide 24 x 7 availability, substantially increasing IT energy demands. These demands, in turn, require more servers, storage, supporting infrastructures, and staff, all of which enlarge the carbon footprint and increase facility services such as office space, lighting, power, and cooling.

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*In organizations with significant IT processes, half of the energy consumption supports IT equipment.*

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As the global population climbs, as growth markets expand, and as more daily events are digitally connected, the demand for data management and processing continues to skyrocket. Through technological advances, data centers can become more productive in a smaller carbon footprint so that capacity is no longer dictated by available space. In addition, power, cooling, networking, storage, and other capacity metrics must also be managed and brought into compliance with tighter governmental regulations around energy consumption. Compliance requires businesses to demonstrate improved efficiency and to report carbon emissions, water consumption, and waste management, among other metrics.

Taking an environmental and resource-efficient approach (“a green approach”) to IT issues has many benefits. Among

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<sup>1</sup> “IBM Software: A green strategy for your entire organization”, IBM Software for a greener world, June 2008:

<ftp://ftp.software.ibm.com/common/ssi/sa/wh/n/sww14000usen/SWW14000USEN.PDF>



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them is an appropriate response to climate change and sustainability, a positive awareness of public opinion, positive financial implications, and improvement in the public profile and brand of an organization. Also, this approach has a social responsibility aspect as organizations realize that “going green” is good for business. In addition to reducing costs and improving efficiency, the green approach positively affects brand image and is a competitive differentiator for clients, partners, and suppliers.

How do you develop a meaningful green strategy that aims for sustainable development, significant gains, business growth, and rewards? You can employ innovation, but your resources are limited and you need new technologies for successful green and sustainable initiatives. To help you get started, turn to IBM. IBM is at the forefront of research, technology, and products and invests in continuous improvement of processes and methods. IBM also has the industry expertise, intellectual capital, and best practices to accelerate time-to-value, to help you implement a green strategy and transform your business to be more efficient, flexible, socially responsible, self-sustainable, and compliant.

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*New technology and automation transform how organizations manage IT infrastructure, from data centers to application development. The key is to stay tuned and build awareness and understanding about emerging technologies.*

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As technology evolves, processing and storage capacity will increase while consuming less energy. You can accomplish this result by reducing your IT carbon footprint and scaling down infrastructures and facilities.

## Implementing the green approach

Companies that currently face energy constraints, which can undermine business growth, can gain competitive advantages by implementing green strategies.

For example, companies that employ energy-efficient data centers realize payback sooner than companies that postpone such initiatives. Having more efficient data centers means that they can meet growing data volume and increasing demand for processing while

managing escalating resource costs. Also, companies must manage physical space, power, and cooling capacity to avoid stranding capacity and must manage the resulting higher operational costs. How can your organization address these requirements at the same time?

When deciding how to implement a green data center, you can choose from many options, for example, from using environmental-free cooling to cloud computing. Figure 1 highlights the key elements to consider when you implement a green data center.

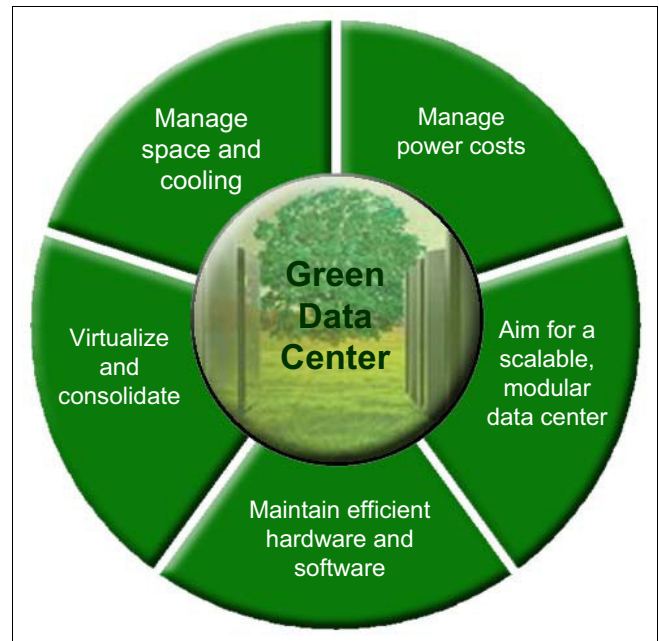


Figure 1 Key elements in a green data center

Select the options that fit your data center based on key criteria. For example, you might consider the type of work that is being performed, the age and state of the infrastructure, environmental conditions around and inside the data center, internal business processes, and economic conditions.

## Efficiency techniques

Efficiency techniques that are based on green technology are the best choices to build IT processes and an energy conscious data center. Figure 2 on page 3 shows the groups of efficiency techniques, which include IT, facilities, and integration techniques.

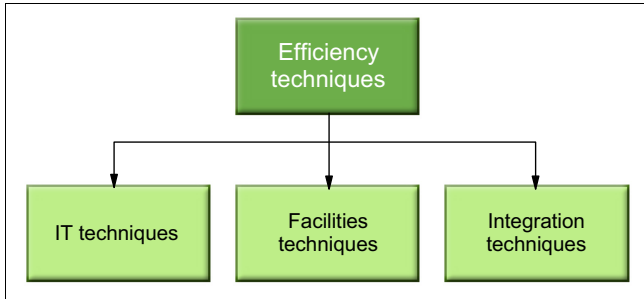


Figure 2 Types of efficiency techniques

You can combine techniques or use them separately. Each technique has a level of complexity for implementation and use and has an associated payback.

The following tables list each group of techniques, with its complexity and payback levels, that you can apply as part of your green data center. Table 1 lists the IT-related efficiency techniques.

Table 1 IT efficiency techniques

IT efficiency technique	Complexity	Payback
Server consolidation and virtualization	High	High
Storage virtualization	High	High
Localized liquid cooling	Medium	High
Software power management	Medium	Medium
Asset level power and thermal monitoring	Medium	Low
Asset IT utilization monitoring	Medium	Medium
Cloud computing	Low	Medium to high
Rear door heat exchange	Low	Low
Data storage management	Low	Low
High efficiency hardware	Low	High

Table 2 lists the facility-related efficiency techniques.

Table 2 Facility efficiency techniques

Facility efficiency technique	Complexity	Payback
Site consolidation	High	High
High efficiency hardware	High	High
Autonomic cooling adjustment	High	High
Free cooling	High	High
Alternative power	High	High

Facility efficiency technique	Complexity	Payback
High DC voltage	High	Low
High- or low-density zone configuration	Medium	Medium
In-row cooling	Medium	Medium
Scalable, modular data center	Medium	High
Direct rack duct cooling	Low	High
Environmental conditions analysis	Low	Medium to high
Hot/cold aisle configuration	Low	High
Structured cable management	Low	Low

Table 3 lists the integration-related efficiency techniques.

Table 3 Integration efficiency techniques

Integration efficiency technique	Complexity	Payback
3-D inventory management	High	High
Branch circuit monitoring	High	Medium
Integrated facility and IT dashboards	High	High
Integrated facility and IT reports	High	High
Asset data access from environmental analysis	High	Medium
Alert and event management	High	High
Data and service association monitoring	High	High
IPDU level power monitoring	Medium	Medium

## Techniques in action

The IBM Green Data Center in Poughkeepsie, New York, grew enormously since the upgrade of existing systems with new high performance, energy efficient models to keep pace. However, as the data center increased processing capacity and delivered more services, it encountered several business problems, such as the following examples:

- ▶ New systems were more energy efficient, but the increase in processing power created a demand for more cooling capacity.
- ▶ It became critical to reassess hardware placement and cooling issues.
- ▶ Temperature alarms from the air conditioning units for the computer room signaled the proximity of the environment to its cooling limits. As a result, hosted equipment was pushed closer to potential failure.

To address these problems, the Green Data Center used a combination of techniques. They included rear door heat exchangers, environmental conditions analysis, 3-D inventory management, hardware and software power management, and high efficiency hardware. They also included integrated facility and IT dashboards; asset-level power and thermal monitoring; autonomic cooling, alert, and event management; asset data access from environmental analysis; and monitoring data and service association.

The results were dramatic. Usage of these techniques, along with IBM and industry best practices for a raised floor data center, resulted in a 50 percent decrease in cooling rack power consumption.<sup>2</sup> This advantage, in turn, lowered the probability of equipment failures and delivered continuous service. The overall solution achieved a data center infrastructure efficiency (DCiE) level of 84 percent and doubled the amount of available processing power without increasing square footage.<sup>3</sup>

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*Efficiency, IT, and integration techniques resulted in a 50 percent decrease in rack cooling consumption, and doubled processing power without enlarging the data center.*

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The Green Data Center used some of the following systems and software to modernize the data center:

- ▶ IBM Cool Blue® Rear Door Heat Exchangers
- ▶ IBM Measurement and Management Technologies
- ▶ IBM System z®
- ▶ IBM Power
- ▶ IBM BladeCenter®
- ▶ IBM System x®
- ▶ IBM System Storage®
- ▶ IBM Systems Director Active Energy Manager™

<sup>2</sup> IBM Poughkeepsie Green Data Center: Achieving data center infrastructure efficiency (DCiE) of 84 percent:  
<http://public.dhe.ibm.com/common/ssi/ecm/en/tic14173usen/TIC14173USEN.PDF>

<sup>3</sup> Ibid

- ▶ IBM Tivoli® Monitoring for Energy Management
- ▶ IBM Tivoli Data Warehouse
- ▶ IBM Tivoli Business Service Manager
- ▶ IBM Tivoli Netcool/OMNIBus
- ▶ IBM Systems and Technology Group - Lab Services

## What's next: How IBM can help

To help you make optimal investments in energy-efficient data centers, to help consolidate IT assets, and to cut costs, IBM offers IT facilities assessment, design, and construction services. IBM can also help with energy-efficiency assessments of your data center to quantify potential energy savings. The results include a turnkey, scalable modular data center that you can deploy quickly.

For more information about energy and environment solutions, go to:

<http://www.ibm.com/ibm/green>

## Resources for more information

For more information about the concepts highlighted in this paper, see the following resources:

- ▶ *Smarter Data Centers: Accelerating the Move to a Smarter Planet*, REDP-4523  
<http://www.redbooks.ibm.com/abstracts/redp4523.html?open>
- ▶ *IBM Poughkeepsie Green Data Center: Achieving data center infrastructure efficiency (DCiE) of 84 percent*  
<http://public.dhe.ibm.com/common/ssi/ecm/en/tic14173usen/TIC14173USEN.PDF>
- ▶ *The green data center*  
[https://www.ibm.com/services/au/cio/pdf/optit\\_wp\\_green\\_data\\_center.pdf](https://www.ibm.com/services/au/cio/pdf/optit_wp_green_data_center.pdf)
- ▶ *How much energy do your IT devices use?*  
[http://www.ibm.com/uk/green/pdf/how\\_much\\_energy\\_do\\_it\\_devices\\_use.pdf](http://www.ibm.com/uk/green/pdf/how_much_energy_do_it_devices_use.pdf)
- ▶ *End user IT energy efficiency study*  
[http://www.ibm.com/uk/green/pdf/end\\_user\\_it\\_energy\\_efficiency\\_study12.pdf](http://www.ibm.com/uk/green/pdf/end_user_it_energy_efficiency_study12.pdf)
- ▶ *IBM Software: A green strategy for your entire organization*  
<ftp://ftp.software.ibm.com/common/ssi/sa/wh/n/sww14000usen/SWW14000USEN.PDF>

- ▶ *Creating a green data centre to help reduce energy costs and gain a competitive advantage*

[http://www.ibm.com/services/uk/igs/pdf/greenit\\_pov\\_final\\_0608.pdf](http://www.ibm.com/services/uk/igs/pdf/greenit_pov_final_0608.pdf)

- ▶ *Cutting the carbon footprint of IT: How to deliver measurable savings*

[http://www.ibm.com/innovation/uk/green/pdf/SOLUTION\\_IT\\_cutting\\_the\\_carbon\\_footprint\\_of\\_it.pdf](http://www.ibm.com/innovation/uk/green/pdf/SOLUTION_IT_cutting_the_carbon_footprint_of_it.pdf)

- ▶ *Centrinet launches UK's first operational zero carbon data centre with help from IBM*

[http://www.ibm.com/services/uk/cio/pdf/final\\_centrinet\\_case\\_study.pdf](http://www.ibm.com/services/uk/cio/pdf/final_centrinet_case_study.pdf)

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This document, REDP-4946-00, was created or updated on November 30, 2012.




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