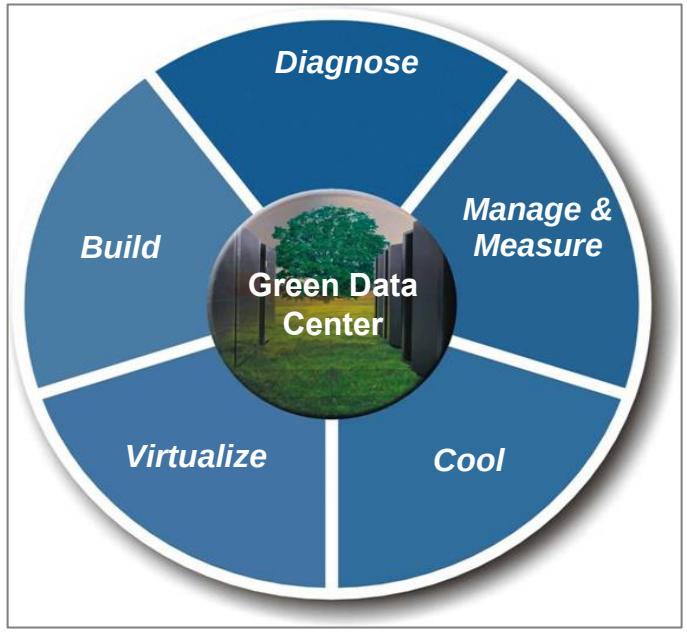
Five Step Plan to Energy Efficiency in the Data Center

Data Center World 2007



agenda

1	IBM Project Green
2	Data center challenges
3	IBM Energy Efficiency Initiative overview
4	IBM physical facilities solutions
5	IBM IT Infrastructure Solutions
5	Getting started

Environmental responsibility isn't something new to IBM

New Goal Announced!

Further extend IBM's early accomplishments by reducing CO_2 emissions associated with IBM's energy use 12% from 2005 to 2012 via energy conservation, use of renewable energy, and/or funding CO_2 emissions reductions with Renewable Energy Certificates or comparable instruments.

Awards & Recognition

BEST Workplaces for Commuters℠ — FORTUNE 500 Top 20 2004, 2005, 2006

ENERGY STAR — 1998, 1999, 2001

CLIMATE LEADERS U.S. Environmental Protection Agency — 2005

WWF climate savers — 2005

USEPA Climate Protection Award 1998 and 2006

The Climate Group 2005

Green Power Purchaser Award 2006

Environmental Efforts at Big Blue

Computer Program Charter Member 1992 — ENERGY STAR

Charter Member 2000 — WWF climate savers

CCX Chicago Climate Exchange — Charter member 2003

SmartWay Transport Partnership

PEW CENTER Global CLIMATE CHANGE — Business Environmental Leadership Council

CLIMATE LEADERS U.S. Environmental Protection Agency — Charter Member 2002

WRI Green Power Market Development Group Charter member 2000

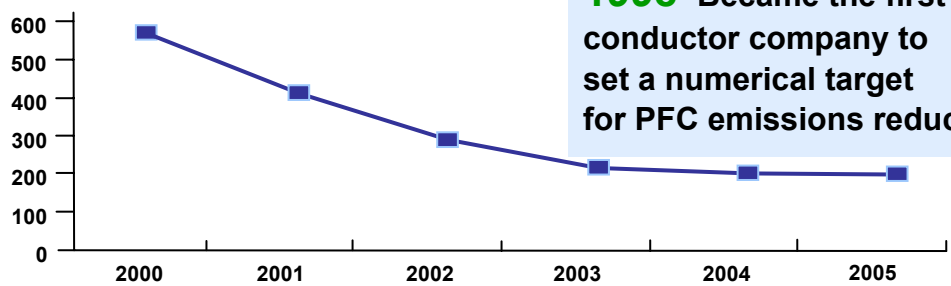
ClimateVISION — 1605(b) voluntary emissions reporting since 1995

CARBON DISCLOSURE PROJECT — Since inception

Early Results

40%

Between 1990-2005, IBM's global energy conservation actions reduced or avoided CO_2 emissions by an amount equal to **40%** of its 1990 emissions.



1998 Became the first semi-conductor company to set a numerical target for PFC emissions reduction

58%

“Project Big Green” is a major new IBM initiative to help our clients achieve greater energy efficiency

- **IBM to reallocate US$1 billion each year:**
  - To accelerate ”green” technologies and services
  - To offer a roadmap for clients to address the IT energy crisis
  - To create a global green team of almost 1,000 energy efficiency specialists from across IBM
  - To offer IBM green solutions that include the strength of IBM’s hardware, software, services, research and financing teams
- **What green solutions can mean for clients:**
  - For the typical 25,000-square-foot data center that spends US$2.6 million in power annually, energy costs can be cut in half
  - IBM estimates that the energy savings equal the reduction of emissions from taking 1,300 automobiles off of the road …or a 3.5 million-pound reduction in coal burned for energy generation

The IBM Energy Efficiency Initiative is built on four core principles that target the needs of today's data center

1. **Energy usage in the data center has a significant impact today—and will have an even greater impact in the future.**
2. **Real solutions are available now that can reduce data center energy usage.**
3. **To meet the challenge, collaboration is a must—across IT technology vendors, data center design and build businesses, infrastructure technology providers, energy utilities and governments.**
4. **Think green. And think ahead. Understanding your energy usage is key. Expert advice can help make savings real.**

Facing new pressures: Data centers are at a tipping point

According to Gartner, "The underlying consumption of energy in large data centers to power and cool hardware infrastructure is likely to increase steadily during the next ten years."[1]

Increased Computing Demand

Changing Cost Dynamics

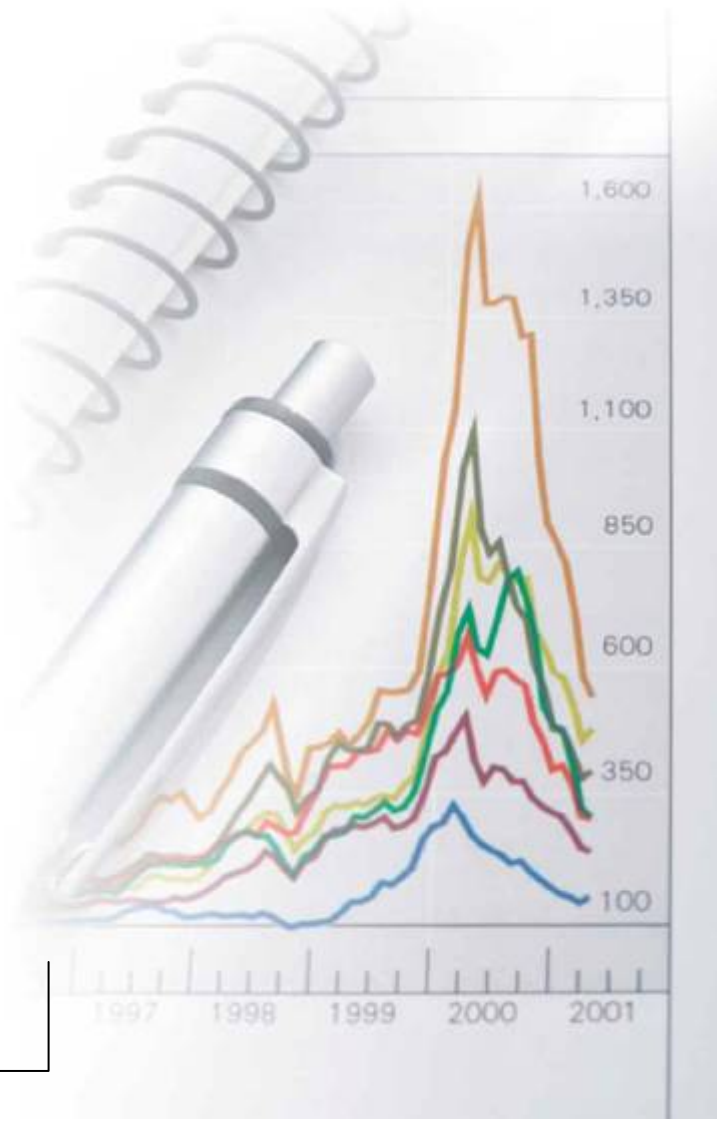
Data Center Lifecycle Mismatch

- **In the next decade, growth in server shipments will be 6x and 69x for storage** – *IBM / Consultant studies*
- **Per square foot, annual data center energy costs are 10 to 30 times more than those of a typical office building.** [2] *- William Tschudi, March 2006*
- **Data centers have doubled their energy use in the past five years.**[3] *- Koomey, February 2007*
- **US commercial electrical costs increased by 10 percent from 2005-06.**[4] *- EPA Monthly Forecast, 2007*
- **"Eighty-seven percent of data centers were built before 2001"**[5]
- **"Twenty-nine percent of clients identified" data center capability affected server purchases** "- *Ziff Davis*

1. Gartner, *Data Center Power and Cooling Scenario Through 2015*, Rakesh Kumar, March 2007.
2. William Tschudi, March 2006.
3. Koomey, February 2007.
4. *EPA Monthly Forecast*, 2007.
5. Nemertes Research, Architecting and Managing the 21st Century Data Center, Johna Till Johnson, 2006.

How can only 10% efficiency improvement help?

- **Save 20 billion kWh per year by 2015**
- **Worth $2 billion (≈ annual electricity use in 1.8 million American homes)**
- **Potentially defer need to build 2,300 MW of new generating capacity**
- **Avoid 3.4 million metric tons of carbon emissions (like taking 675,000 cars off the road)**
- **Extend life and capacity of existing data center infrastructures**



Data source: *Creating Energy-Efficient Data Centers, , U.S. Department of Energy , May 18, 2007*

5 Level Green Data Centers are energy efficient and environmentally responsible

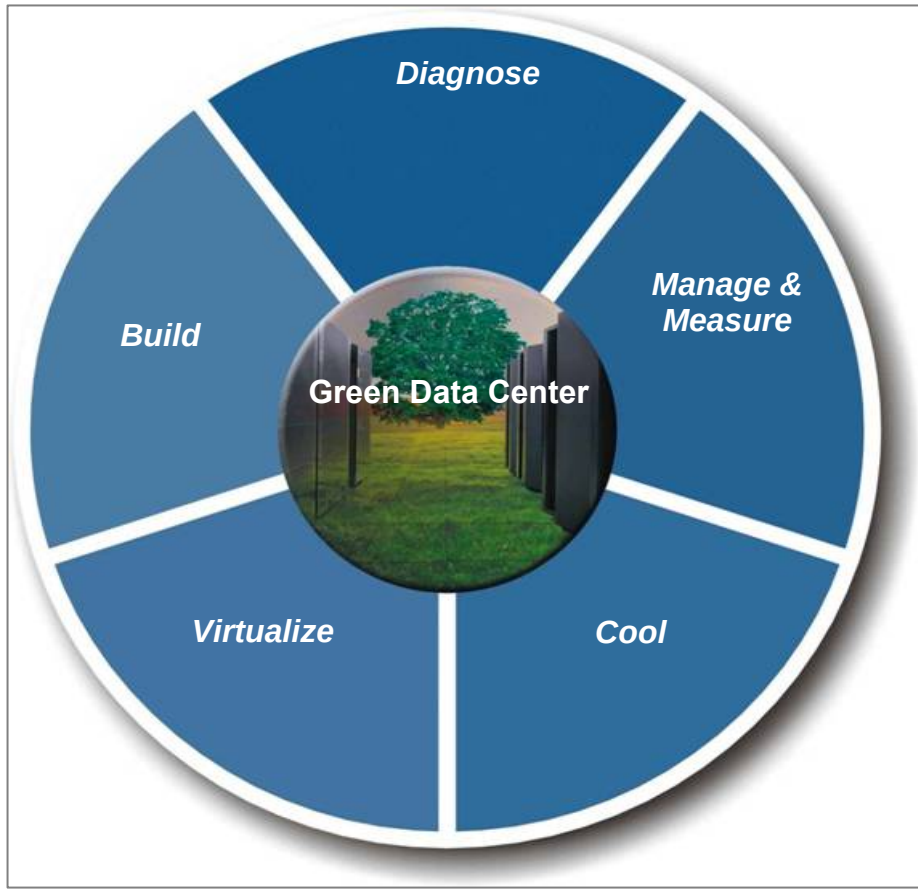
Diagnose
Get the facts to understand your energy use and opportunities for improvement

Manage & Measure
Seize control with power management software

Cool
Use innovative cooling solutions

Virtualize
Implement virtualization and other innovative technologies

Build
Plan, build and upgrade to energy efficient data centers



Where does the energy go? The data center energy challenge affects both the physical data center and the IT infrastructure

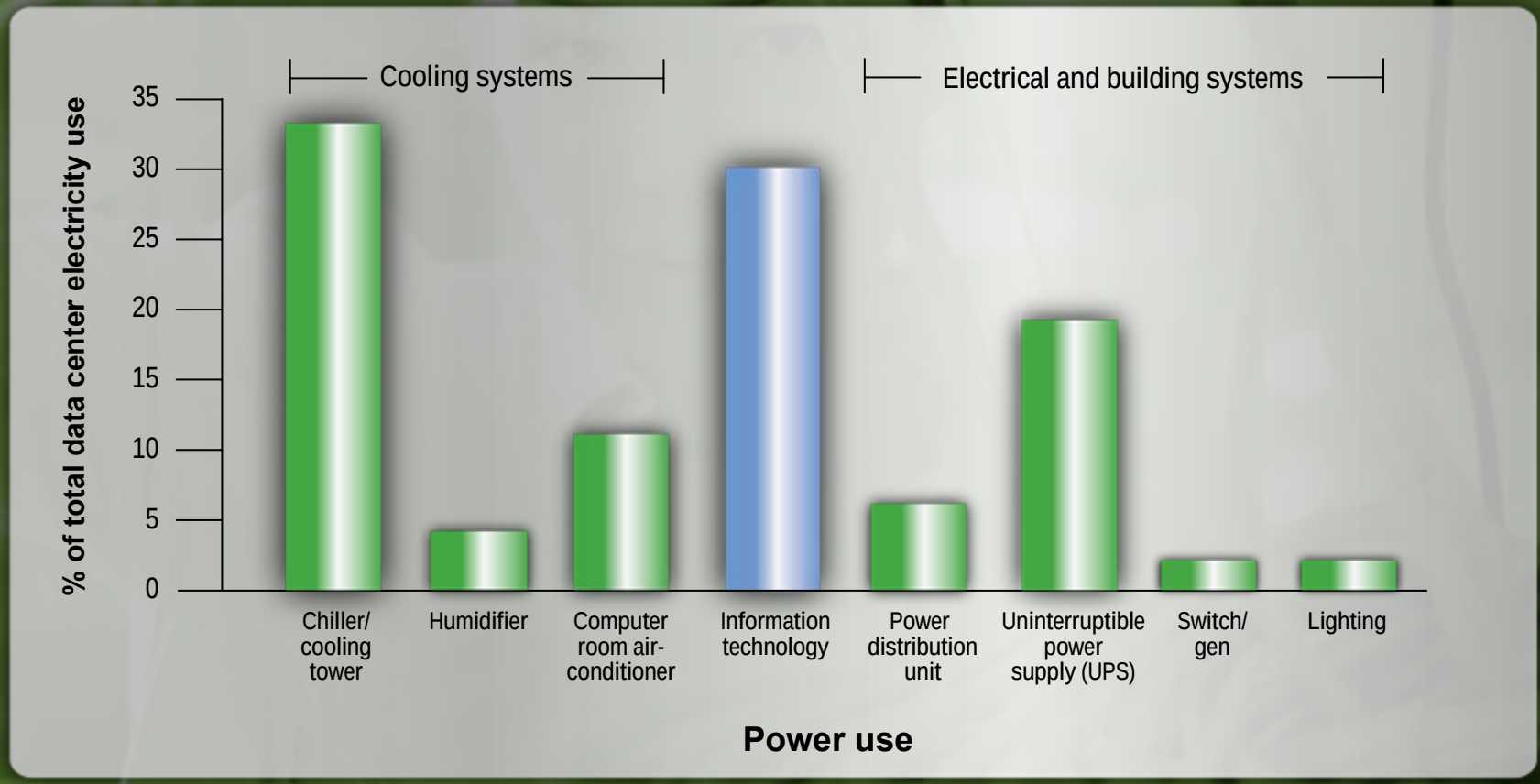


Chart and data source: American Power Conversion Corporation (APC) white paper, Implementing Energy Efficient Data Centers, #114, by Neil Rasmussen, 2006.

IBM helps across the broad range of solution points

Energy Solutions

- Data Center Energy Efficiency Assessment
- Data Center Stored Cooling Solution
- Optimized Airflow Assessment for Cabling
- Scalable Modular Data Center
- Server Optimization and Integration
- Accelerator for Rationalization
- Server and Storage Power/Cooling Trends and Data Center Best Practices
- Data Center Thermal Analysis and Optimization Facilities Integration

Energy Management

- IBM Director with PowerExecutive
- Power Configurator to plan your power usage
- Leadership virtualization capabilities extend beyond simple partitioning
- Tivoli® Enterprise Management

PowerExecutive

Power Configurator

Virtualization

Tivoli

Energy Technology

Power Architecture™
Processor efficiency management

System designs
More performance
Less kilowatts

Virtualization
Standard feature in most systems

X-Architecture™
Processor efficiency management

Rear Door Heat Exchanger
Thermal management innovation

IBM power supplies
Measurement built in

Calibrated Vector cooling
Reduces wasteful air movement

BladeCenter
Energy Efficiency from the ground up

IBM offers a comprehensive portfolio of solutions to help you optimize your IT facilities around the world

IBM Data Center and Facilities Strategy Services

We help you identify your requirements, capabilities and capacities, and define your optimal “green” and high-resiliency options

IBM IT Facilities Assessment, Design and Construction Services

Providing capabilities to design and build new data centers or improve existing ones

IBM IT Facilities Consolidation and Relocation Services

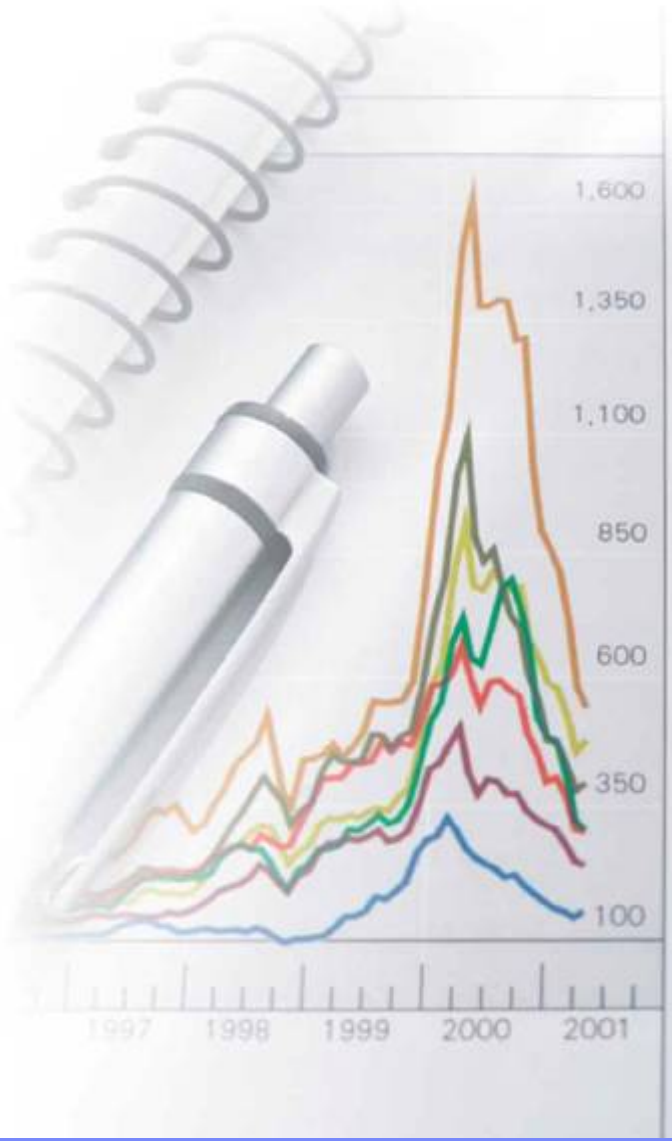
Helping you take advantage of savings and redundancy through consolidation and relocation, leveraging IBM local presence around the globe to help minimize risk

IBM Specialized Facilities Services

Providing leadership on design and construction requirements for state-of-the-art clean rooms, intelligent/green buildings and trading floors

Assessment and analysis capabilities for IT Infrastructure

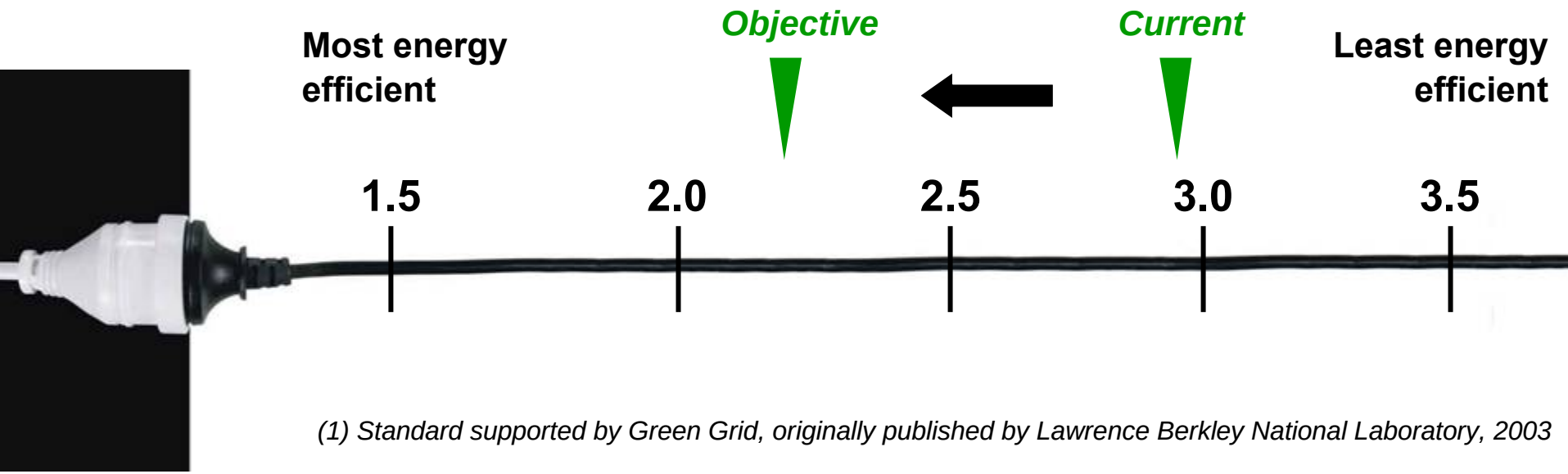
- **IBM Data Center Energy Efficiency Assessment**
  - Compare data center energy efficiency to a set of standards and discover opportunities to improve efficiency
  - Clients can reduce energy costs by up to 40 percent
- **IBM Energy Efficiency Self-Assessment**
  - Online tool to conduct quick and easy energy efficiency assessment
- **Energy Efficiency Incentive Finder**
  - Web-enabled clearinghouse for incentives from local utilities, governments, and other agencies around the world
- **IBM Thermal Analysis for High Density Computing**
  - Identify and resolve existing and potential heat-related issues
  - Helps prevent outages and provide options for power savings and expansion



Data center energy efficiency assessment

A simple standard to assess data center energy efficiency

- Compares total power used by the data center to the power used by the technology
- Provides a market comparison
- Demonstrates range for opportunity improvement



(1) Standard supported by Green Grid, originally published by Lawrence Berkley National Laboratory, 2003

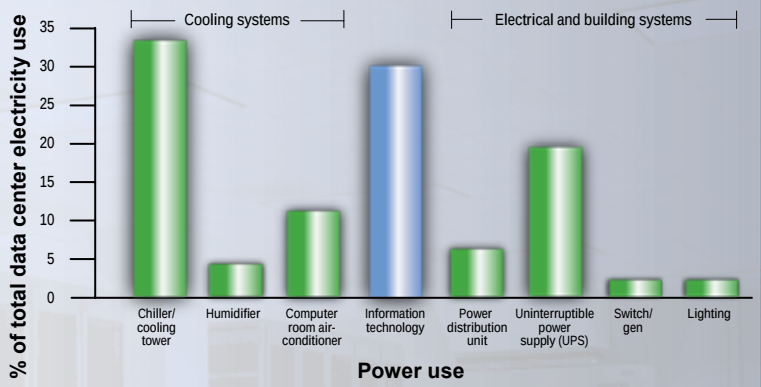
Data center energy efficiency assessment—facts you need

Description:

- IBM provides a comprehensive, fact-based analysis that prioritizes tactical plans across your data center to help improve efficiency and reduce costs

Potential benefits:

- Energy savings: infrastructure upgrades can provide 15–40 percent savings
- Opportunities identified— recommendations can include:
  - Standard comparison
  - Low performance areas
  - Actions for improvement
  - Business cases to prioritize investments



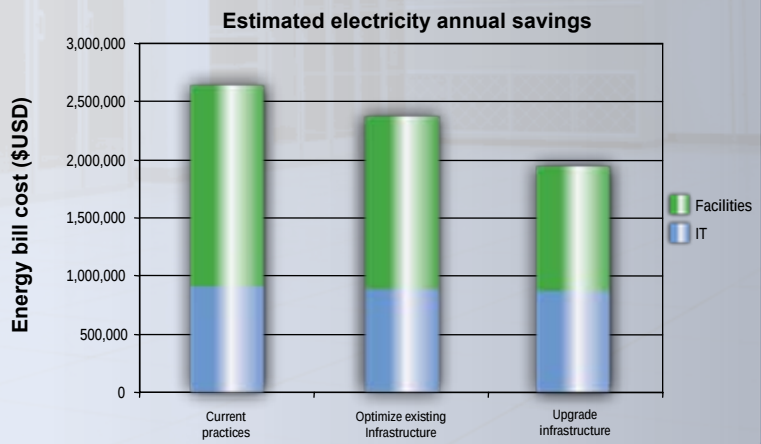


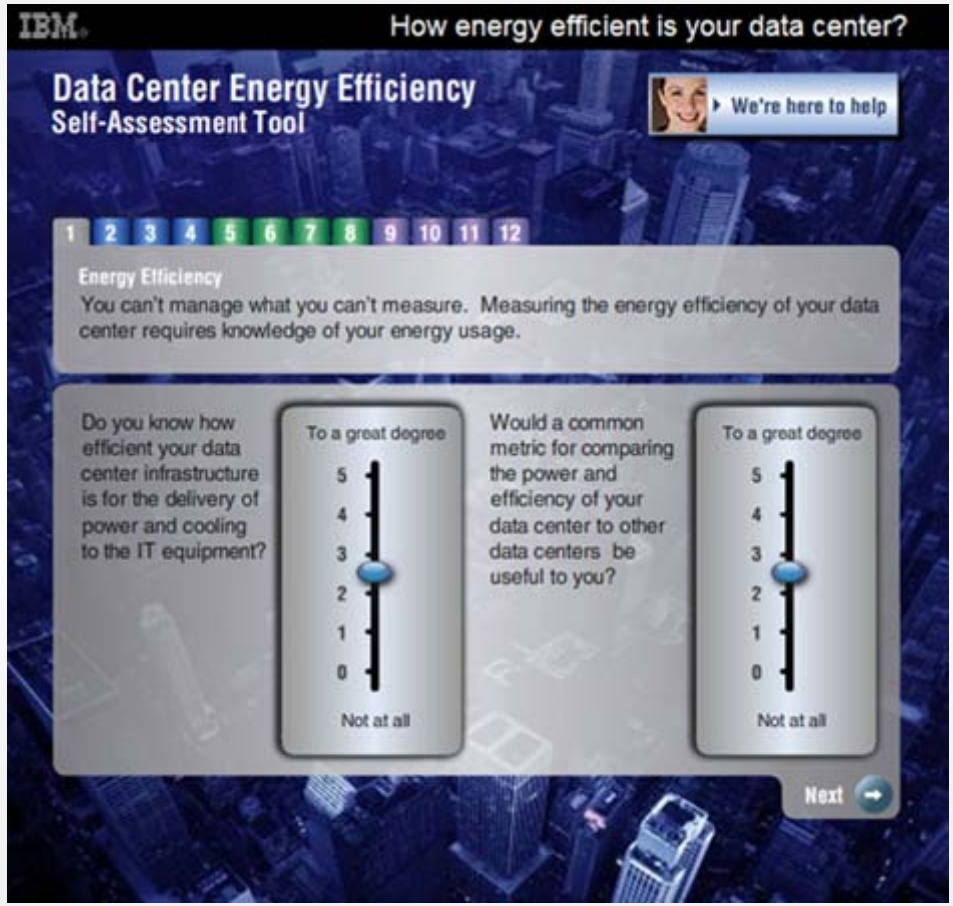
Chart and data source: American Power Conversion Corporation (APC) white paper, Implementing Energy Efficient Data Centers, #114, by Neil Rasmussen, 2006.

Web-based energy efficiency self-assessment tool

Assessment Process

- Twelve questions on energy usage
- Three main categories
  - Awareness of power related issues
  - Deployment of tactical quick hitters
  - Extent of strategy data center planning
- Report on improvement areas
- IBM Service recommendations

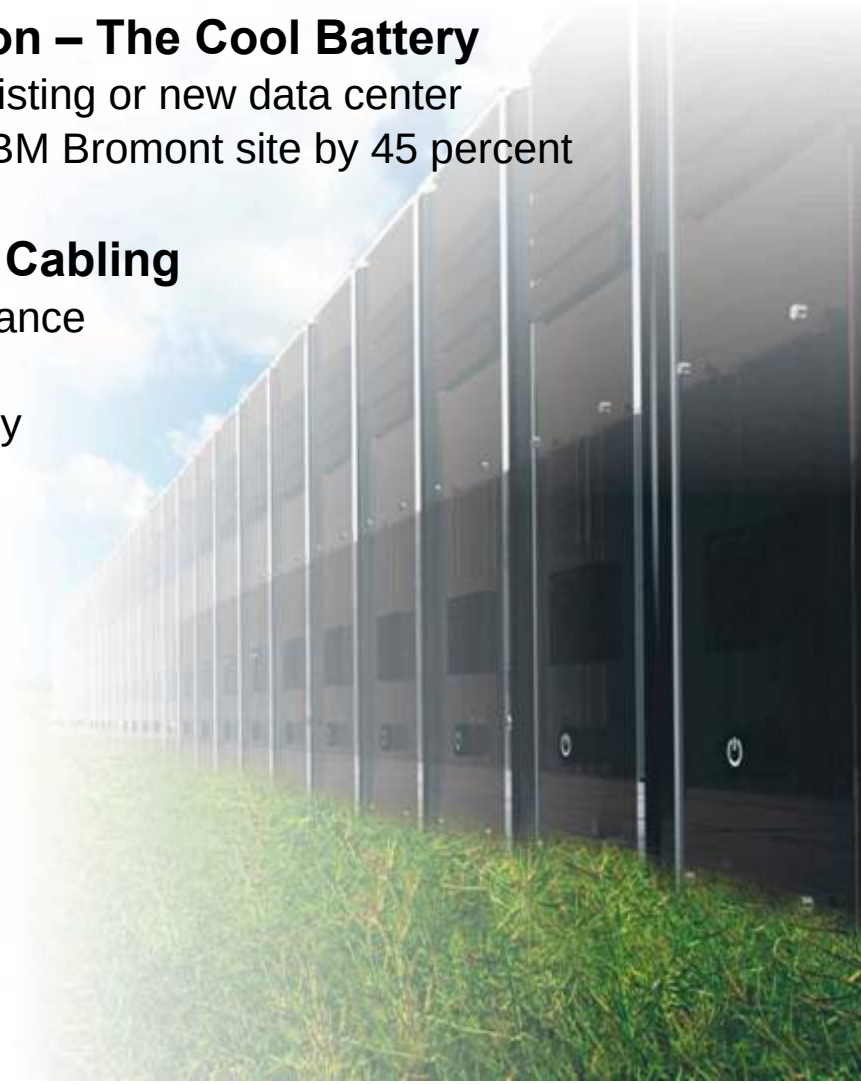
Free self assessment available on the Web to highlight opportunities for energy efficiency improvement



ibm.com/itsolutions/optimizeit/cost_efficiency//energy_efficiency/services.html

Solutions to build/update energy efficient data center

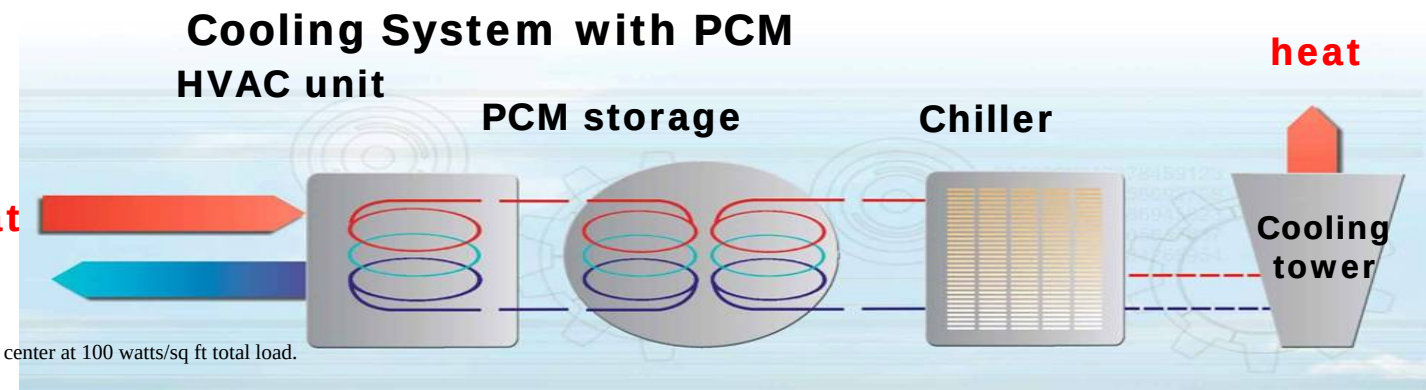
- **IBM Data Center Stored Cooling Solution – The Cool Battery**
  - Improve efficiency of the cooling plant in existing or new data center
  - With Cool Battery, IBM cut energy cost of IBM Bromont site by 45 percent
- **IBM Optimized Airflow Assessment for Cabling**
  - Replace cabling systems with high-performance fiber transport systems
  - Yields improved cooling and reduced energy usage across data center
- **IBM Scalable Modular Data Center**
  - Provides ready racking, power, cooling, security and monitoring
  - 500 and 1,000 square foot data centers can be deployed in 8 to 12 weeks
  - About 15 percent below the price of a traditional approach
  - IBM manages integration and coordination of data center



IBM Data Center Stored Cooling Solution - an innovative cooling solution that can help increase chiller plant's energy efficiency by as much as 50 percent

- Our solution is designed to save $260,000-$430,000* per year by:
  - Optimizing the efficiency of equipment that is often over-provisioned, causing it to run at low utilization and efficiency
  - Shifting energy consumption for cooling to off-peak hours when utility rates are lower
  - Helping to ensure optimal efficiency at virtually all times with specially designed monitoring and control capability
  - The solution leads the industry in energy- and space-efficiency
  - 20 times better than chilled water storage
  - 4 times better than ice storage
  - Latent heat far superior to that of water

Thermal storage device between computer room air conditioners and chillers



*Energy savings based on 25,000 sq ft Tier III data center at 100 watts/sq ft total load.

IBM has helped companies around the globe increase the energy efficiency and reduce expenses of their IT Infrastructure

Data Center and Facilities Strategy

- **Super computing:** Built the #1 super computing center (Mare Nostrum) for high redundancy with extremely dense computing environment
- **Financial:** Built 50 large Chinese data centers – including the country's top 5 banks

IT Facilities Consolidation and Relocation

- **From many to few:** ICBC – 38 to 2 centers; $180M in annual savings
- **Without interruption**: 4 to 1 centers with no interruption; ~$11M in annual savings
- **When uptime is critical**: Relocation of Wake Medicals hospital data center – without patient impact

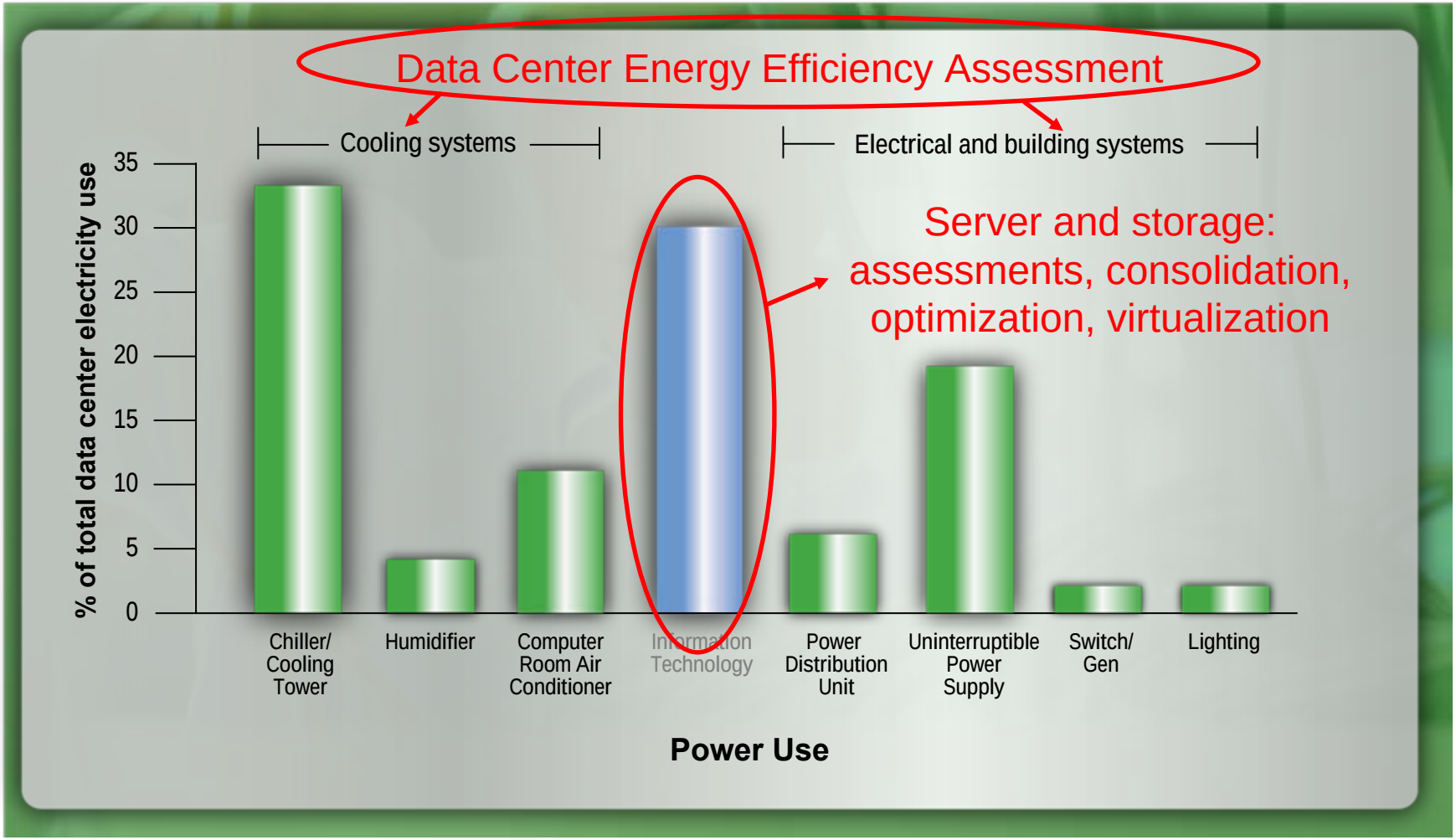
IT Facilities Assessment, Design and Construction

- **Deep experience:** **>**30 M sq ft of raised floor
- **Global breadth:** Building largest client data centers for Egypt Telecom and India
- **Wide array of assessments:** energy, resiliency and new technology adoption
- **All size businesses**: Small client solutions at Bryant University

Specialized Facilities

- **A green leader**: Designed and built > 35 percent of the top rated green / Intelligent buildings in Japan
- **When precision matters**: Design and building of facilities for clean rooms for chip fabrication and pharmaceutical companies

The data center energy challenge affects both the physical data center *and* the IT infrastructure.



Business dynamics are driving clients to focus on the *usage* and *management* of their IT environment

MANDATED TO REDUCE AND CONTAIN IT COST

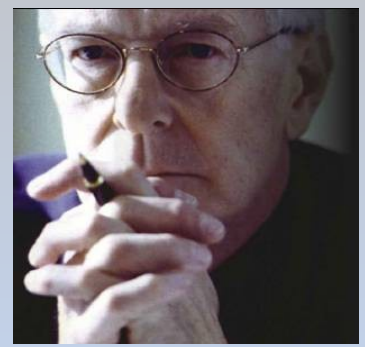
- Rising hardware, software and support costs
- Increasing number of IT projects and shrinking IT budgets
- IT Staff is being asked to improve the utilization and performance of existing assets
- Desire to transform IT from a fixed to variable expense
- Infrastructure Initiatives require a compelling ROI to justify the investment

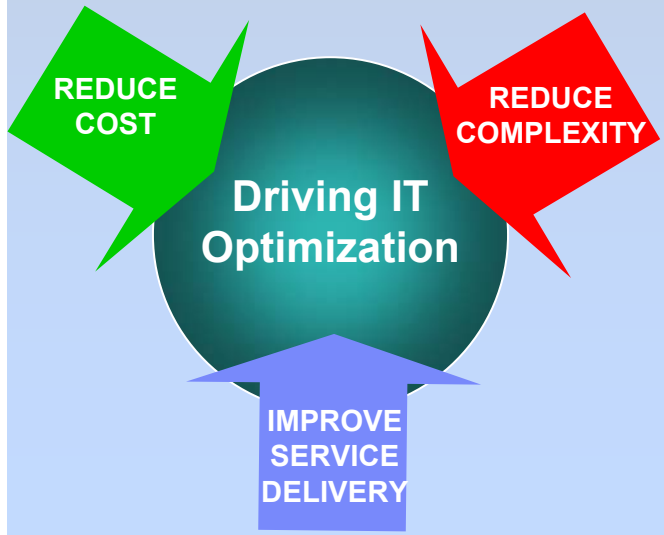
CHALLENGED TO REDUCE COMPLEXITY

- Existing server and storage environments have 'organically grown' to be complex
- Facing increased regulatory requirements
- Introduction of new technologies

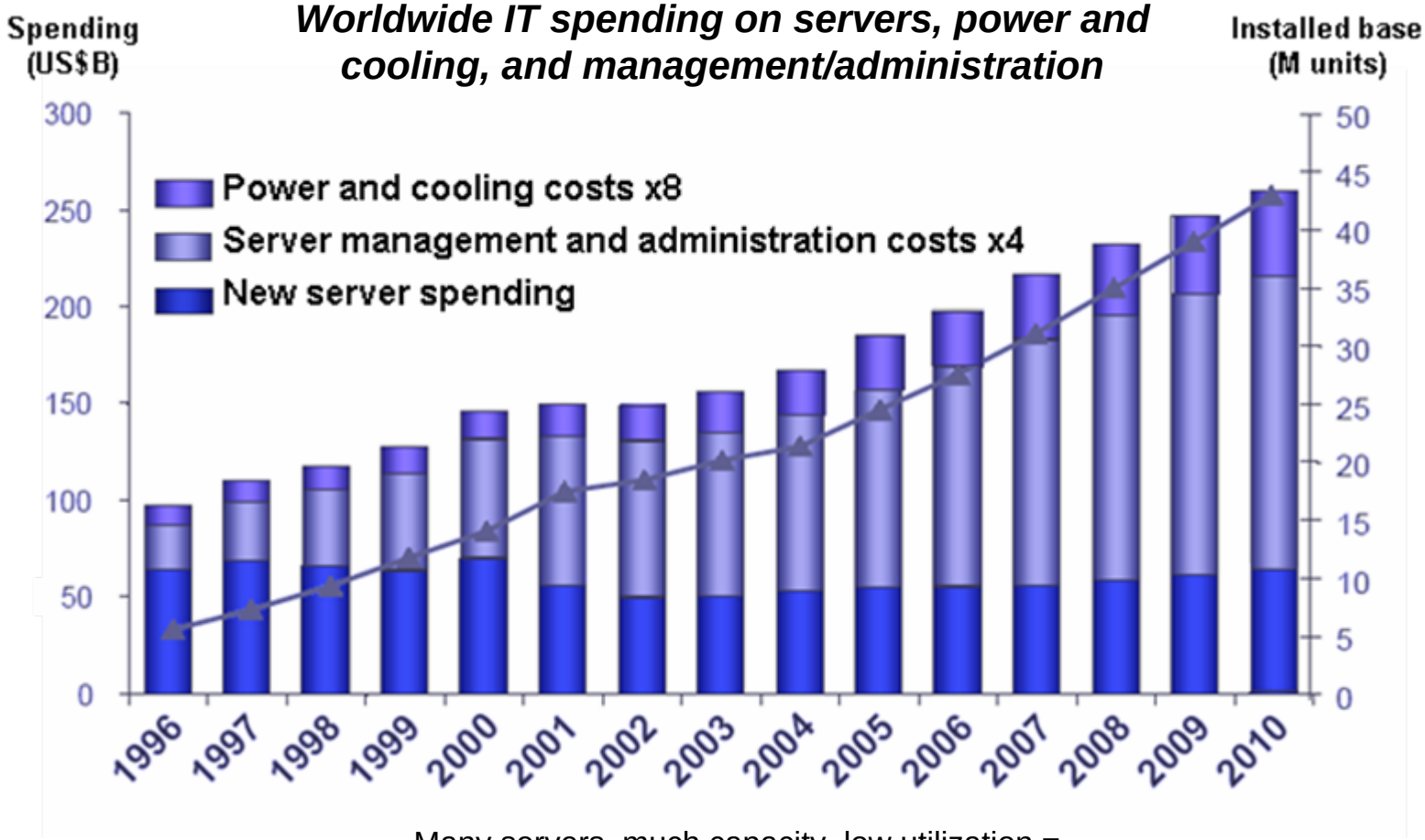
CHALLENGED TO DELIVER IT SERVICES EFFECTIVELY

- Lack of effective application deployment and capacity planning processes
- Business units are often resistant to shared environments and resources
- Finding it difficult to implement changes to the supporting processes and policies
- Lack of standardized operations and procedures coupled with
- Manual processes presenting potential risk to their business





Clients challenged with improving server operations performance while containing server TCO



Many servers, much capacity, low utilization =
US$140B in unutilized server assets

Source: IDC Enterprise Server Research, 2007.

But it's more than TCO: Flexibility and manageability match costs savings as motivators

Why is your organization interested in server consolidation?

	2003	2004	2005	2006
1. Provide total cost of ownership (TCO) savings	56%	48%	38%	38%
2. To gain control and manage the systems better (security, availability, disaster recovery)	36%	44%	45%	41%
3. To provide better service and agility	6%	7%	15%	18%
4. Other	2%	2%	2%	3%
Total respondents	**175**	**103**	**249**	**85**

"We have seen a growing realization that server consolidation provides more than just the possibility of TCO savings."

—Gartner*

Source: Gartner, Inc. "Data Center Conference Poll Shows Server Consolidation Is Still a Major Goal." John R. Phelps. January 29, 2007.

Clients are also experiencing an explosion in storage capacity and complexity

- **Storage drivers**
  - Business applications (healthcare, media, retail, government, etc.)
  - Internal drivers (email, digital media, CAD/CAM, and web)
  - Availability demands
  - Retention requirements
  - Information Lifecycle Management (ILM)
  - Regulatory environment
  - Unstructured data
- **Storage impact**
  - 50-60% capacity growth
  - 15+% of IT budget
  - High complexity
  - Low utilization

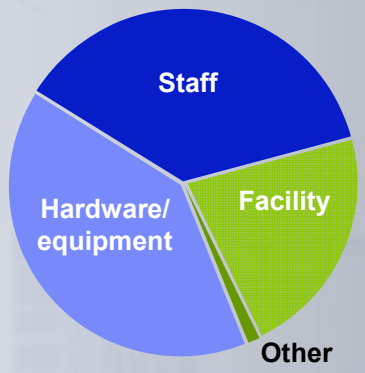
Accelerator for Rationalization – Starting on the path to a consolidated and virtualize your infrastructure

IBM helps clients define scope of server and storage consolidation engagements to improve efficiency and reduce operational costs.

Offering benefits

- Save up to an average of 72% in datacenter operational costs*
- Recommendations include:
  - High-level business case
  - Estimated savings based on consolidation
  - Satisfaction criteria
  - Inventory of server & storage landscape

Consolidation savings can come from:



Categories	Savings
Maintenance	86% - 94%
Software support	82% - 84%
Personnel	36% - 50%
Facilities	65% - 70%
Average	72%

"Impact of IBM System p Server Virtualization," Transforming the IT Value Equation with POWER6 Architecture. International Technology Group, 05/2007. Study methodology: Companies in financial services, manufacturing and retail with $15 Billion+ revenues focusing on UNIX® large enterprise environments with multiple, broad-ranging applications. Study compared the cost of the company's workloads running on multiple vendor servers and employing minimal virtualization to the cost of the company's workloads running on p 570 (POWER6 processor-based) as well as POWER5+ processor-based servers – all using Advanced POWER Virtualization [APV]. APV is standard on System p5 590 and 595. Other System p servers have the option to add APV except the System p5 185. This cost analysis was performed for financial services, manufacturing and retail example environments with an overall average savings of up to 72% in TCO savings by virtualizing and consolidating on the System p servers. Total Cost of Ownership may not be reduced in each consolidation case. TCO depends on the specific customer environment, the existing environments and staff, and the consolidation potential.

Server and storage consolidation can reduce complexity and costs, while optimizing performance, utilization and adaptability

- Consolidate
  - ✓ To reduce a client's server infrastructure and increase the utilization of the new environment
  - ✓ Optimize systems management processes to more efficiently manage new infrastructure technologies
- Automate
  - ✓ To substitute tools and technology for manual processes and infrastructure controls
- Update/Replace
  - ✓ To take advantage of new technology and best practices by replacing older, obsolete or inefficient infrastructure components and management processes
- Streamline
  - ✓ To create a simplified server infrastructure
  - ✓ To modify processes for a more efficient and consistent management structure
- Eliminate
  - ✓ To remove unnecessary components and processes from the client's infrastructure

IBM Server Optimization and Integration Services – server consolidation provides a foundation for optimization

- Delivers **design, strategy, planning, implementation and testing services** for creating a consolidated environment from heterogeneous server infrastructures
- Provides access to **consolidation methodologies and tools** and a center of competency that utilizes the expertise of highly skilled IBM professionals
- Creates a **foundation for more advanced optimization initiatives** such as virtualization and service-oriented architecture (SOA)

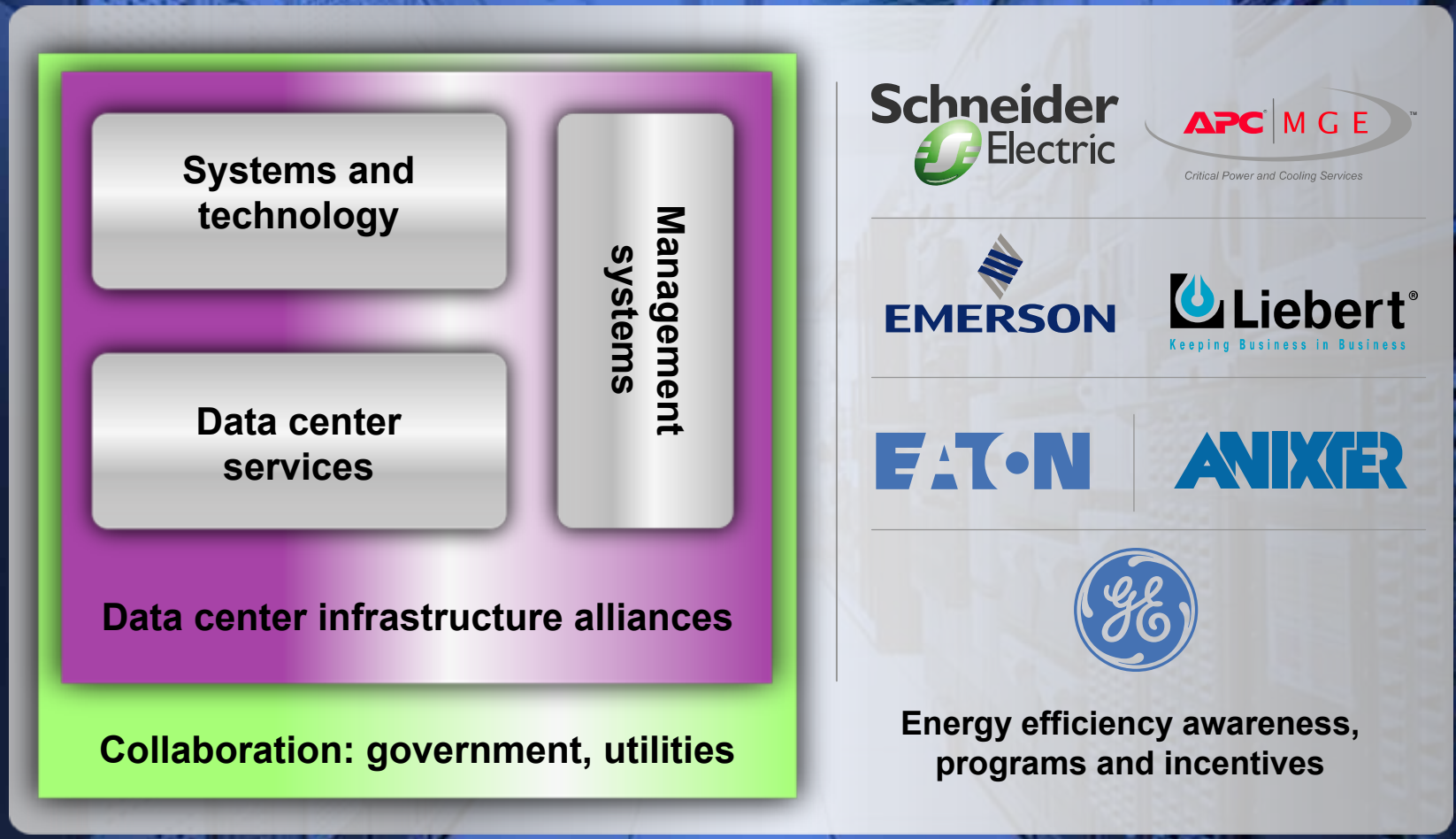
Storage Optimization and Virtualization helps reduce cost and simplify

- Increase storage infrastructure **utilization** and **flexibility**
- **Eliminate** many of the causes of storage-related **downtime**
- Simplify management
- Match the cost and speed of the storage to the value of the data
- Reclaim/consolidate storage space
- Accelerate data migration
- Enable changes to the physical storage with minimal or no application disruption
- Create a common platform and API for copy services

Sample Offerings

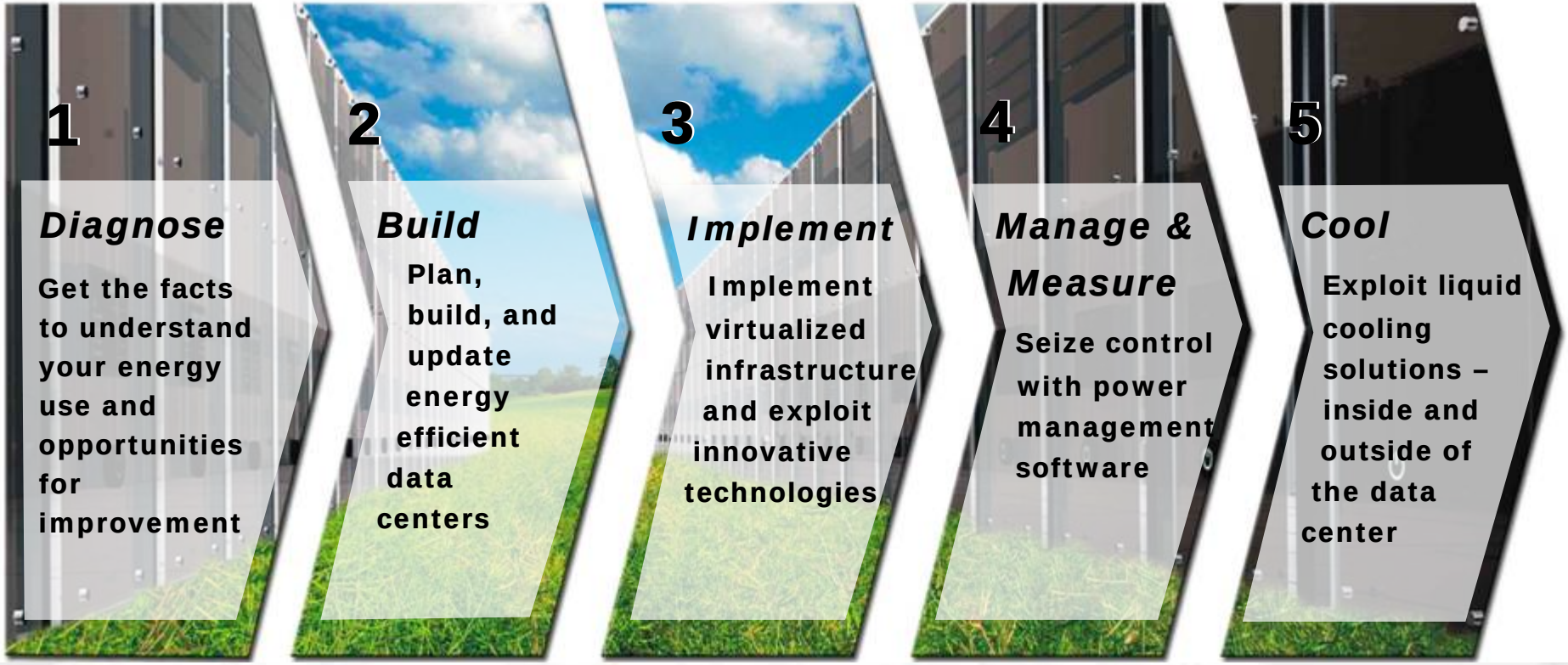
- Storage Virtualization for Storage Management Planning & Design
- SAN Volume Controller (SVC)
- TotalStorage Productivity Center

The IBM Energy Efficiency Initiative is a comprehensive set of capabilities from IBM, our alliances and the communities in which we live.



How do I get started?

Build a Green Plan using a 5-Step roadmap



IBM is uniquely capable of integrating technology, services, and industry expertise to help you manage and use energy in a more cost-effective, efficient, and environmentally-sustainable way.

What should I say to senior management?

"Financial benefits of energy efficiency can reduce the squeeze on our IT budget."

- *Ability to accurate view baseline energy cost*
- *Cost savings from more efficient energy use*
- *Relax budgetary pressures allows for future growth*

"Adopting best practices in power and cooling is operationally achievable."

- *Utilize more energy efficient technologies to get more work per kilowatt*
- *Shift ratio of energy to cool / energy to operate*
- *Ability to properly service, maintain, extend the life of IT equipment*

"We can reduce our environmental impact."

- *Reduced impact to the environment*
- *Meaningful energy conservation*
- *Positive contribution to the Green movement*
- *Improved public image*

Proposed client next steps

- Let us help you get the facts on energy efficiency
  - You can't manage what you can't see (or measure)
  - Take the Energy Efficiency Web Self-Assessment ibm.com/itsolutions/optimizeit/cost_efficiency/energy_efficiency
- Leverage IBM experience in energy efficiency and resiliency
  - Apply it to the tactical problems your data center faces
  - Address your physical infrastructure, IT technology or both
  - Use it across your enterprise including data center consolidation and new data center building plans

Thank You!

Success story: Swiss retailer consolidates servers and implements virtualization

Innovation challenge

- To support a new line of cash-and-carry retail shops, the company needed to support new applications
- The performance of its existing servers was already being affected

Solution

- Two IBM System p5™ 570 servers featuring advanced virtualization technology
- Consolidation design and implementation services from IBM Global Technology Services

Results

- The retailer gained the ability to adjust more quickly to changing business requirements
- The System p5 platform has enabled the retailer to reduce its overall IT costs, while providing faster and more efficient processors and improved utilization rates

Success story: worldwide shipping company

Innovation challenge

- Business strategy: Become the leading global logistics provider by 2005
- IT strategy: Consolidate and refresh business applications and IT infrastructure from multiple acquisitions to support:
- One global company running on one global, consolidated set of enterprise applications
- One global, consolidated view of enterprise data

Solution

- Consolidate 22 data centers into 3 data centers
- Consolidate 2,600 servers into 1,600 servers
- Consolidate 1,520 applications into 200 applications
- Consolidate all data warehouses/marts into one global Teradata warehouse
- Consolidate all legacy financial applications into SAP
- Consolidate all legacy CRM applications into Siebel

Results

- ROI metrics: Increase annual profits by € 1.4 billion by 2005 based on this consolidation and restructuring

Success story: electronics and appliance manufacturer

Innovation challenge

- Simplify its SAP enterprise resource planning environment with a server consolidation project
- Cut IT operational costs and lower total cost of ownership while increasing flexibility and performance

Solution

- Worked with IBM Global Technology Services to consolidate more than 40 servers onto 3 IBM System p5 570 servers with 24 IBM POWER5™ microprocessors running the IBM AIX® 5L™ operating system

Results

- Lowered long-term support and maintenance costs
- Increased ability to scale its SAP architecture more easily and incorporate usage-based billing to control the cost of workload peaks
- Increased performance
- Enhanced data security

Success story: IT services provider for the auto industry

Innovation challenge

- Deploy a virtualized server environment to better position the company for future expansion
- Find an experienced technology provider to assist with implementation

Solution

- IBM Global Technology Services helped consolidate 50 Intel® processor-based servers onto two powerful new IBM System p5 595 servers running the IBM AIX operating system
- IBM deployed one System p595 server at the client's primary data center and another at a disaster recovery site
- IBM Global Technology Services provided in-depth training

Results

- Freed up data center space and reduced power and cooling costs
- Simplified server management
- Increased flexibility and capacity utilization