Managing the New Enterprise Data Centre

Nicholas Drabble

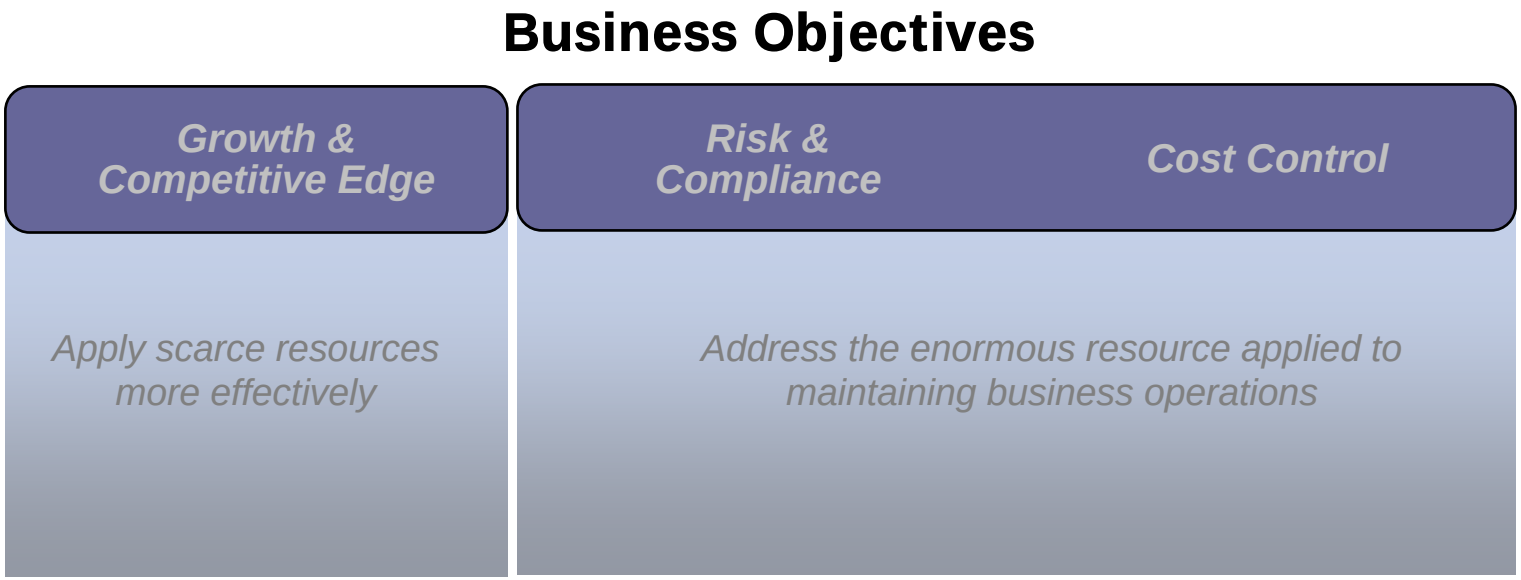
Green Computing Programme Manager

IBM Software Group – UK, Ireland

Tomorrow's Data Centre June 2008

Innovation drives competitive advantage

Innovation is the process of delivering new products, services, processes and business models to create unique competitive advantage and accelerate growth.



'Many inhibitors make innovation more challenging….'

Multiple new factors are driving Organizations

Costs

Oil reaches $135 a barrel
May 2008

Regulatory Mandates

Increased regulatory scrutiny, with government regulations around water usage, carbon emissions etc

"Going Green"

Workload Growth

Growth in Application and Business workloads doubles every 2 years driving the need new servers, DASD, power and cooling

Operational

Capacity shortages for data centre power and cooling are limiting ability to expand

Social & People

Customers have started evaluating the green credentials of suppliers and products

Cultural Shifts

Demographics changes and global teams require collaboration across cultural, generational and geographic boundaries

Environmental responsibility is a core IBM value

New Goal Extension

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

Green IT Supplier of the Year 2008

Green Infrastructure Project 2008 IBM & DEFRA

Environmental Efforts

Computer Program Charter Member 1992 — ENERGY STAR

Charter Member 2000 — WWF climate savers

CCX Chicago Climate Exchange — Charter member 2003

SmartWay Transport Partnership

ClimateVISION

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

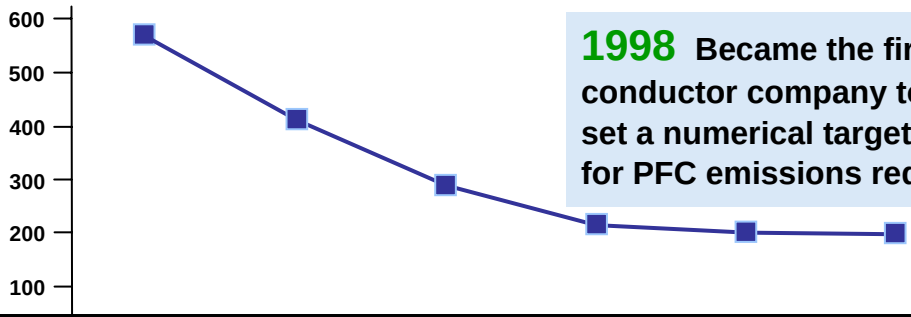
1605(b) voluntary emissions reporting since 1995

CARBON DISCLOSURE PROJECT — Since inception

Long History

40 %

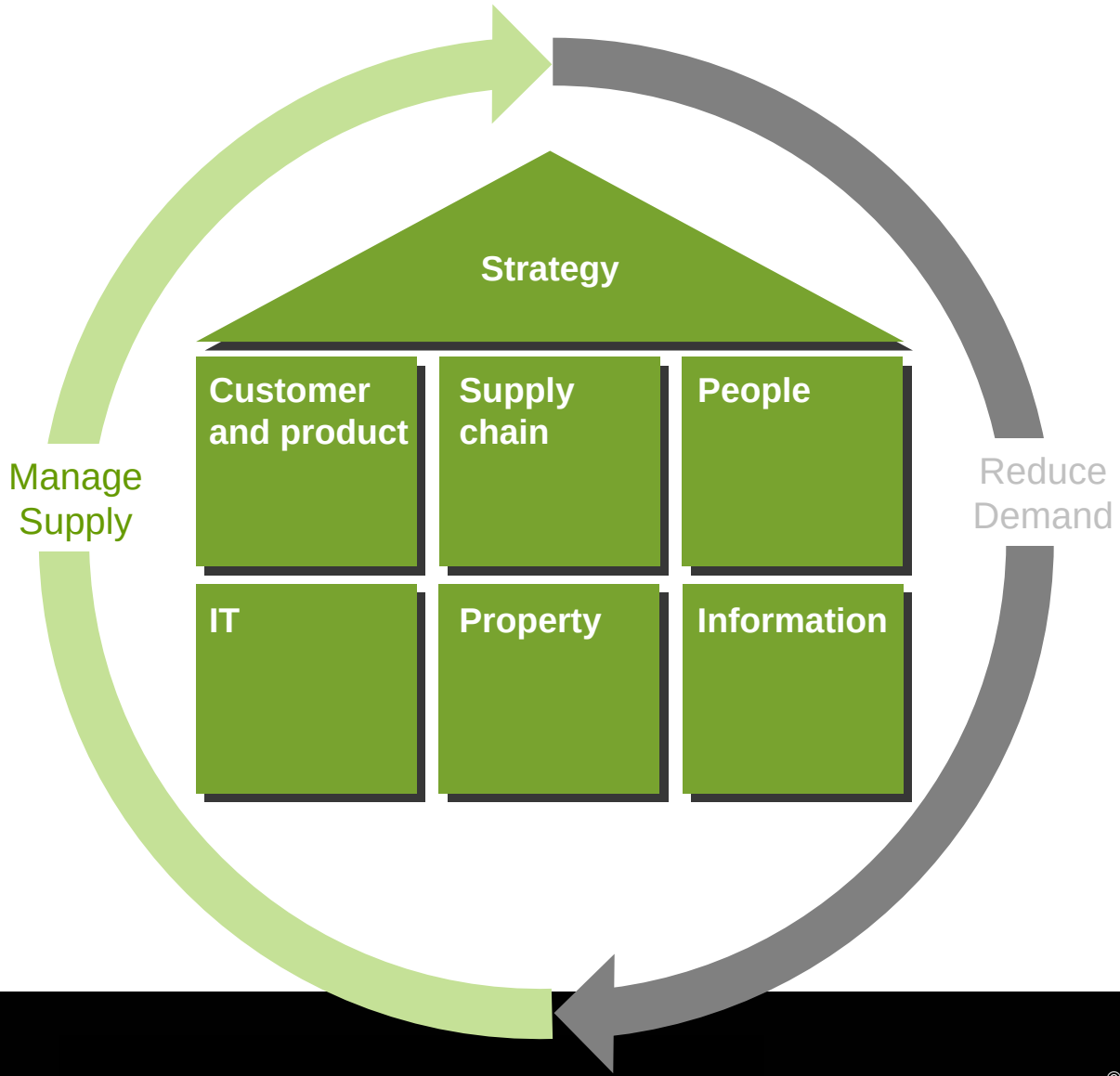
Between 1990 and 2005, IBM's global energy conservation actions reduced or avoided CO_2 emissions by an amount equal to 40% of its 1990 emissions.



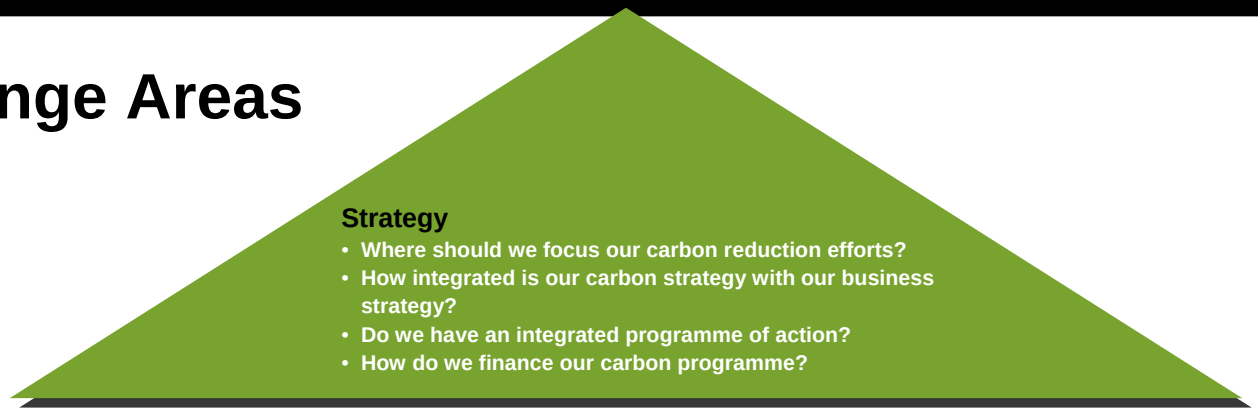
1998 Became the first semi-conductor company to set a numerical target for PFC emissions reduction

58 %

Introducing the IBM Carbon Management Model



Challenge Areas



Customer and product
- How do we communicate our green credentials to our customers?
- What are the new green market opportunities and how do we exploit them?
- How can we design our products to be more carbon-friendly?
- How do we optimise these benefits throughout the full product lifecycle?

Supply chain
- How can we make our end-to-end operations more carbon-friendly:
  - Manufacturing?
  - Logistics?
  - Procurement?

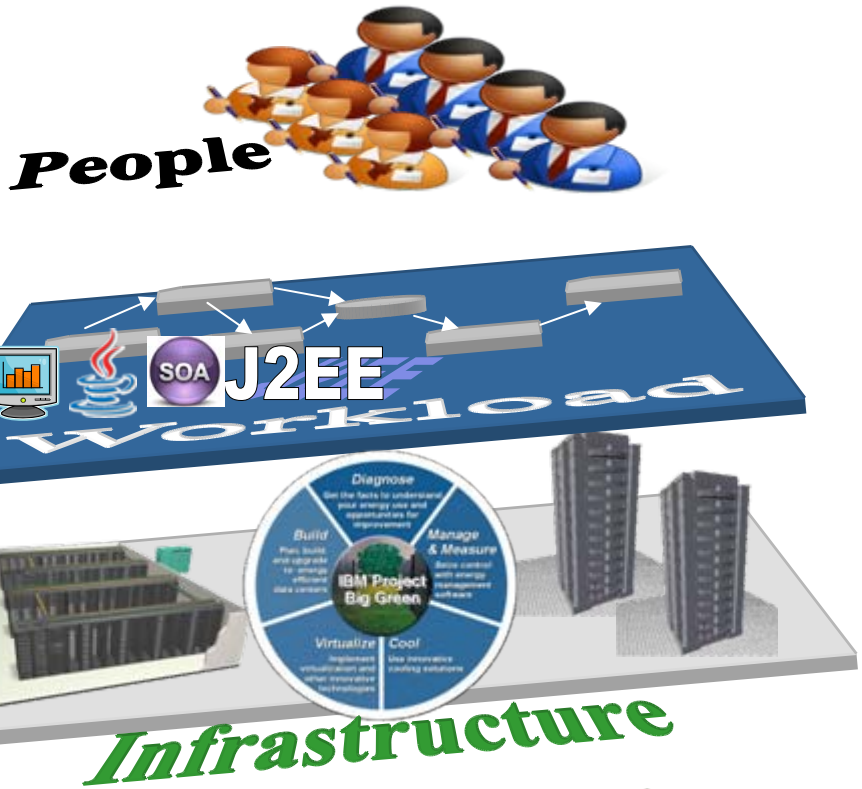
People
- How do we establish and implement effective green HR policies:
  - Strategy?
  - Travel?
  - Home working?
- How do we engage with our employees on the green agenda?
- How do we enable and sustain behaviour change across our organisation?

IT
- How do we integrate carbon management into our IT Strategy?
- How do we identify which areas of IT provide the greatest opportunities for carbon reduction?
- How do we reduce and minimise carbon in each area of IT – both now and in the future?
- How do we optimise to get more IT capacity for less carbon?
- How do we address immediate capacity/power issues?

Property
- How do we reduce carbon in our:
  - Buildings and offices?
  - Production plant?
  - Distribution centres?
- How does the property portfolio contribute to our carbon footprint and how can we improve it?
- How do we work towards a more sustainable property portfolio?

Information
- How do we measure and monitor information on carbon consistently and efficiently?
- How can we best visualise information to allow carbon management by LoB?
- How do we demonstrate regulatory and policy compliance?
- Do we have a carbon scorecard and key performance measures?

Extended Attributes of a Greener Organization



Optimized **People** resources and collaboration beyond boundaries to drive business growth while reducing travel and physical real estate costs

Efficient execution of business **Workloads** with processes and applications designed to maximize energy efficiency while meeting business needs.

Visualization, control and automation of **Infrastructure** to deliver a power efficient organization. Leverage consolidation, virtualization, and optimization.

So . . . How can Software make you greener?

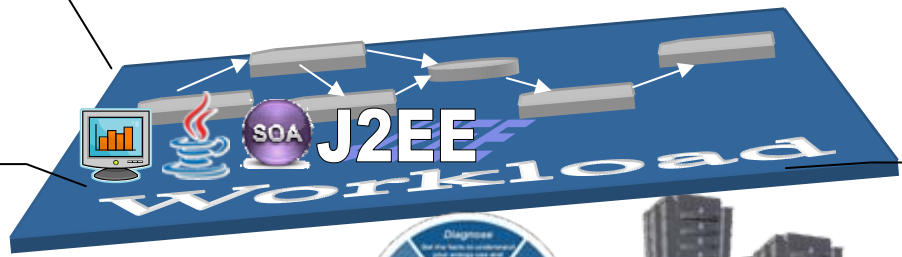
Virtualize the infrastructure to reduce amount of IT staff needed to maintain servers

Reduce commuting with online collaboration and increasing work from home

Reduce business travel by using online collaboration

Reduce use of paper by enabling business processes to use eForms and images

Shift workloads to underutilized servers to reduce energy and floor space needs



Optimize business processes to reduce energy footprint and costs of operations

Schedule execution of workload to off-peak hours to use lower cost energy

Turn the power down when work (transactions) slows down

Compress your data to lower storage and server needs

Optimize HVAC for hot spots to reduce energy consumption

Consolidate and Virtualize to eliminate floor space and compute infrastructure

What does ‘Green’ data centre mean?

Not everyone thinks ‘***Green***’

More likely ***‘Virtualisation’***

‘Optimisation’

‘Energy efficiency’

‘Out of Power or Space’

‘Reduce operational cost’

Evolving to “Tomorrow’s Data Centre”

- Data centre optimisation and utilisation
- Energy efficiency (measuring, collecting, analyzing, visualisation)
- Data Centre Virtualisation
- Effective management of the facility and IT as a holistic entity
- Increased agility to meet business priorities and demands

“We’ve only ever been told to perform … but never efficiently”

The New Enterprise Data Center

An evolutionary new model for efficient IT delivery . . .

New economics: Virtualization with optimized systems and networks to break the lock between IT resources and business services

Rapid service delivery: Service management enables visibility, control and automation to deliver quality service at any scale

Aligned with business goals: Real-time integration of transactions, information and analytics - and delivery of IT as a service

Enabling The New Enterprise Data Center

A holistic, integrated approach

Enterprise Information Architecture

Highly Virtualized Resources

Security and Business Resilience

Efficient, Green and Optimized Infrastructure and Facilities

Business-Driven Service Management

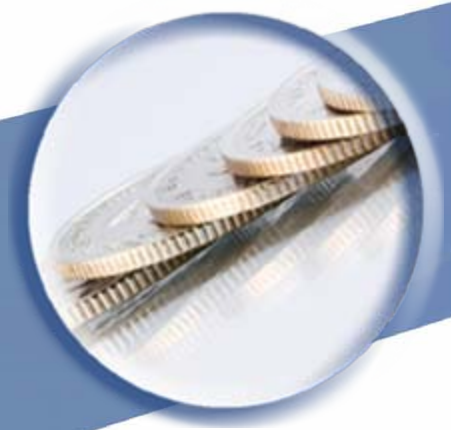
Simplified – Drives IT efficiency

Physical consolidation and optimization

Virtualization of individual systems

Systems, network and energy management

Simplified



UPMC

IT Service Transformation Program

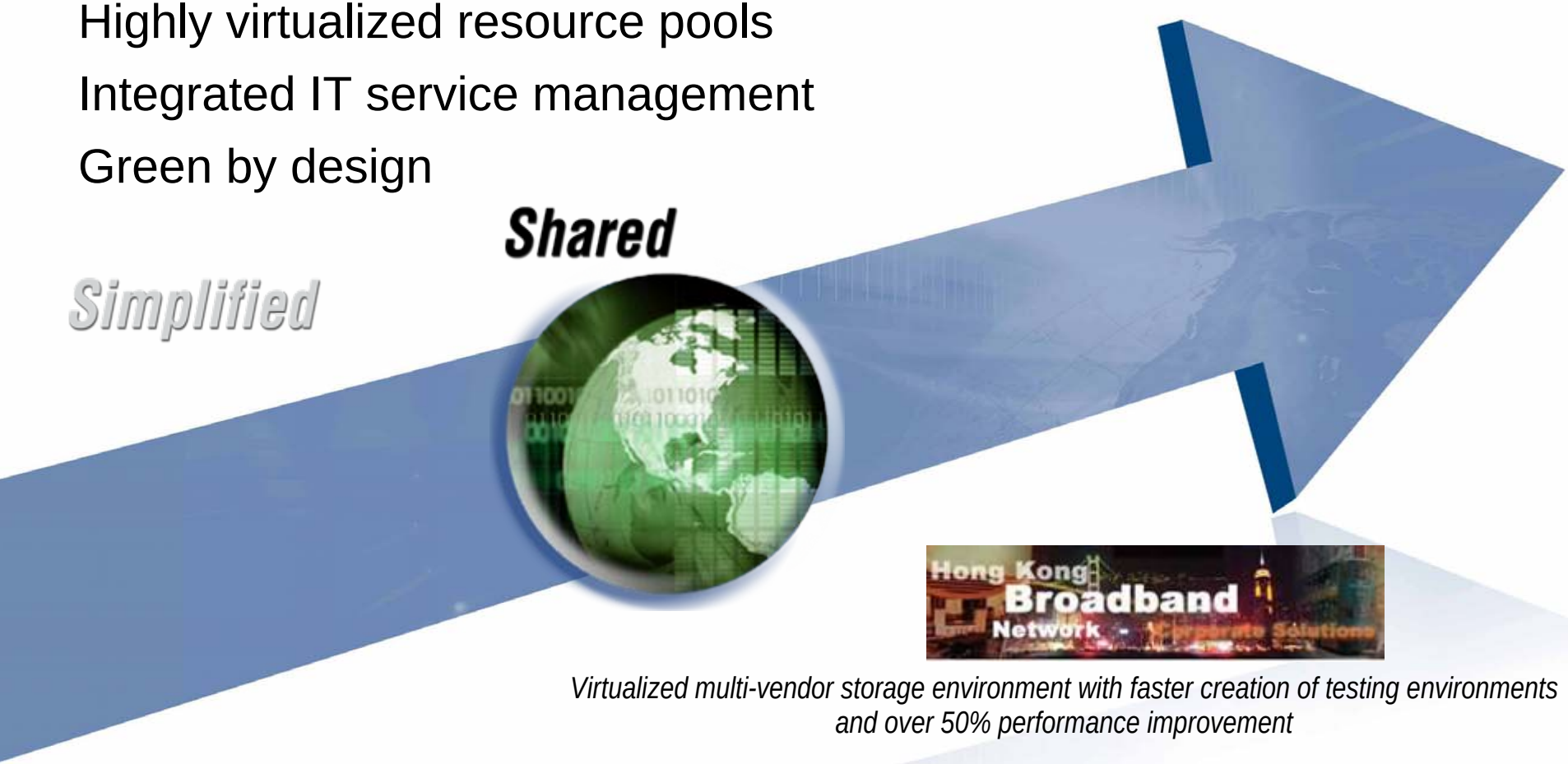
Consolidation and virtualization of servers and storage reducing complexity, energy and labor for $40M est. cost reduction

Shared – Rapid deployment of new infrastructure and services

Highly virtualized resource pools

Integrated IT service management

Green by design



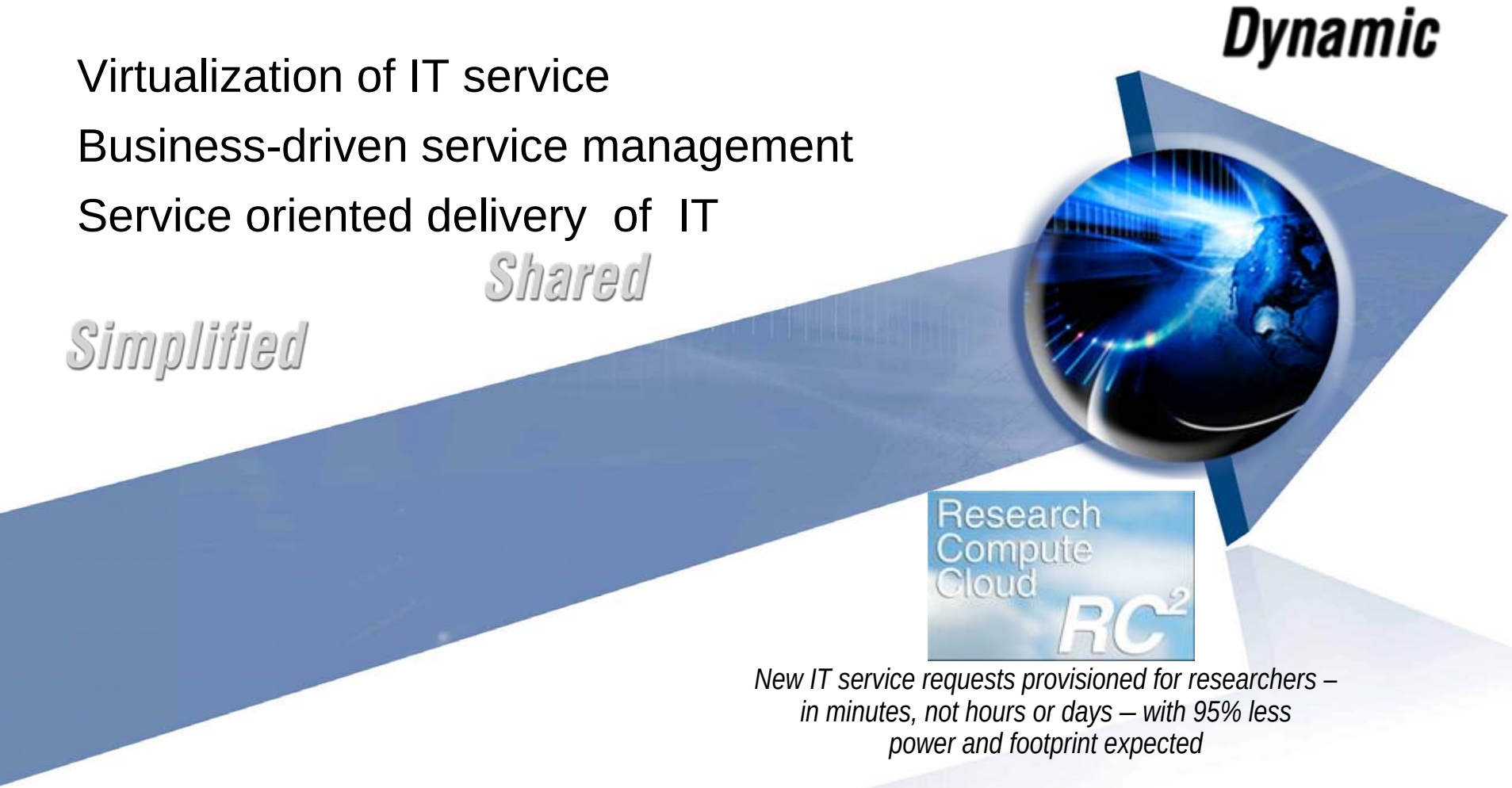
Virtualized multi-vendor storage environment with faster creation of testing environments and over 50% performance improvement

Dynamic – Highly responsive and business goal driven

Virtualization of IT service

Business-driven service management

Service oriented delivery of IT



New IT service requests provisioned for researchers – in minutes, not hours or days – with 95% less power and footprint expected

This transformation spans across
people, process and technology…

People

- **Skills shift from operations (break / fix) to IT Business Analysts**
- **Break down silos and organize around IT service delivery**
- **Paradigm shift toward shared environment**

Process

- **Standardization**
- **Disciplined**
- **Repeatable and documented processes**
  - Change and configuration management
  - Process automation

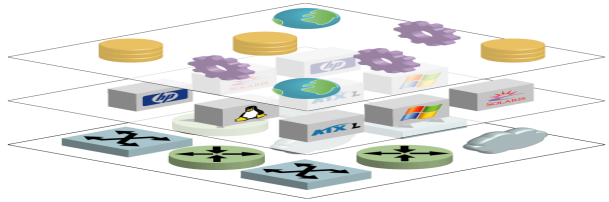
Technology

- **Open standards**
  - Open management across server, storage, networking
  - Open networking standards
- **Role of systems and networking in recentralization**
- **Intelligent automation of IT & Facilities**

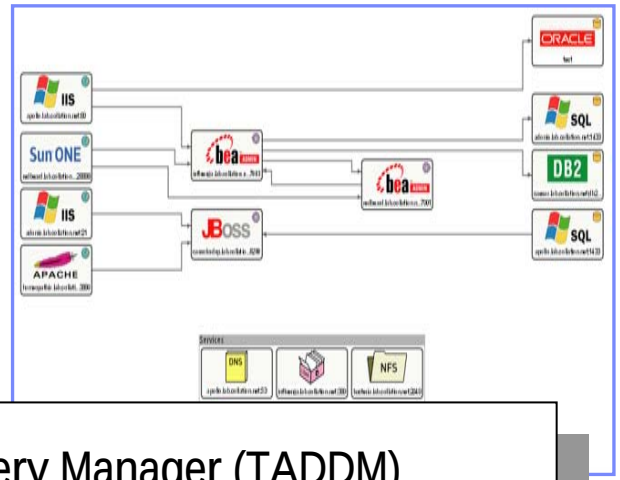
Software innovation - changing the game

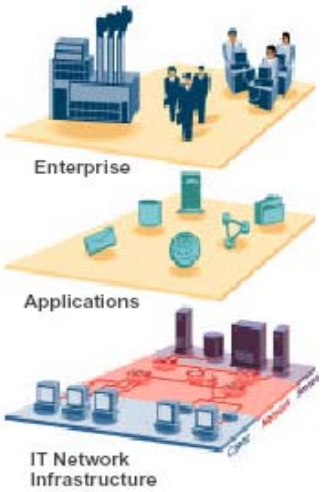
- Better **Visibility** of data centre assets and change is critical
- Improve **Utilisation** and footprint through server consolidation and **Virtualisation** with capacity management & provisioning
- Extend systems **Monitoring** to include **Power and environmentals** with **Spatial capability** and integrated **Asset Management**
- Manage **Data Storage impact** on power consumption dynamically
- Extend Service Management to encompass critical Services and **Active Energy Management**
- Integrating **People**, **Process** and **Technology** with **Workflow Automation**
- **Charging** internal and external customers for these new utility resources

Visibility – Discovery and Mapping



- Understand what assets are actually in the Data Centre
- How they are configured, changes applied and service impact
- Understand inter-dependencies and business service linkage
- How they are being used – what is critical and what is redundant
- The drift from standards and what to 'course correct'





Tivoli Application Dependency Discovery Manager (TADDM)

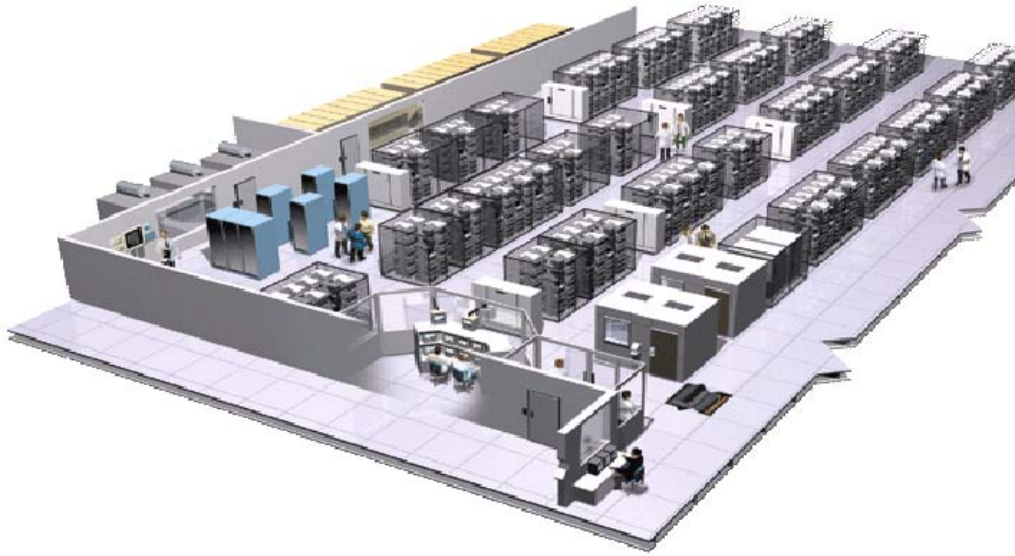
Agent-less Discovery automates application mapping and device discovery

Records change for compliance and audit control

Populates CCMDB and integrates with IT Service Management processes

Consolidate, Virtualize, and Optimize by Provisioning with Energy Intelligence

Provision new servers as needed instead of keeping servers activ standby mode via ***Tivoli Provisioning Manager***

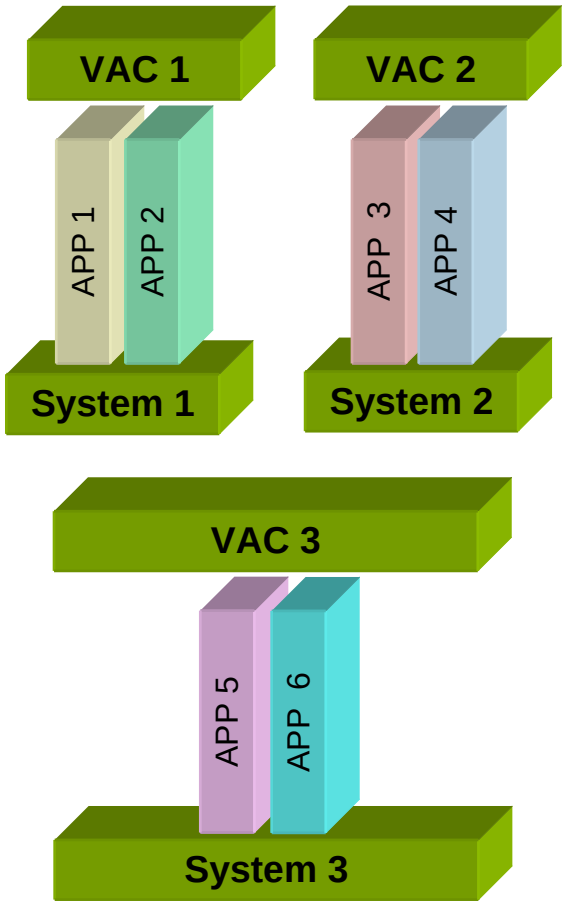


Utilize virtualization to increase utilization of individual servers a eliminate unneeded servers.

Move workload to alternative data centers where energy is less

Support for mainframe, VMWare, MS Virtual Server, LPAR, DLPAR. Provisioning of servers, storage and network infrastructure.

Energy Management Example
Dynamic server consolidation & integrated facilities



Use of hibernation, powering off servers, and other low power states in combination with other workload balancing and provisioning tools can provide a valuable tool in management of Power and Thermal issues.

Automate Energy Control
Policy based automation

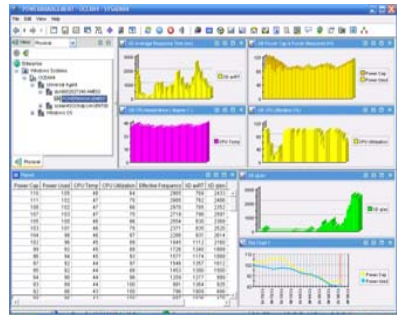
Control Energy Consumption
Consolidate workloads to reduce

Integrated Facilities Control
Match cooling & heat loads

Monitoring for active energy management

Tivoli Monitoring family provides the ideal platform for gathering IT and enterprise events for effective operations

Critical resources can be monitored for availability and running data, including events relating to power, temperature and system stability from many sources including:



- IT Infrastructure – Systems, software, applications
- Facilities – Generators, Air Conditioning

Event management has traditionally been limited to IT assets only, however intelligent facilities equipment can now be integrated e.g.

- HVAC (Heating, Ventilation, Air Conditioning)
- Intelligent power supplies and generators

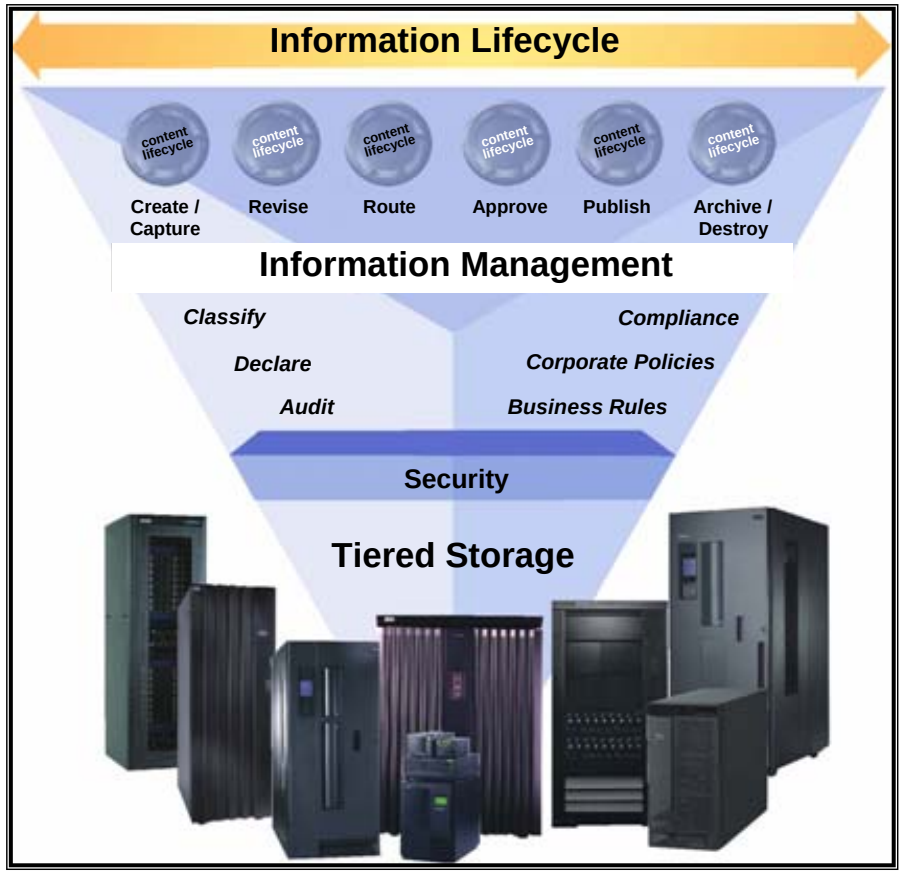
Power efficiency in Information Risk Management

Tivoli Storage management

Virtualise the storage
All storage can appear as a cohesive platform to increase utilisation

ILM traditionally was to . . .
Move data to the most cost effective storage for its current use

In the future it will . . .
Move data to the most power efficient storage that satisfies usage requirements



Data Centre Security and Entitlement

Tivoli security solutions provide a seamless operational and enterprise approach to Security, Risk & Compliance.

Manage enterprise threats and vulnerabilities

Deliver continuous and reliable access to information and services

Manage identity to enable secure, seamless collaboration

Increase compliance & reduce reputation risks and audit deficiencies

Virtualised management of enterprise entitlement and access

Maintaining a securely managed data centre provides business resiliency and effectiveness in managing highly virtualised, dynamic and efficient data centres.

Managing the converged asset lifecycle

Discover & manage the lifecycle of assets, from procurement to decommissioning

Understand the energy efficiency of assets, from servers to HVAC units

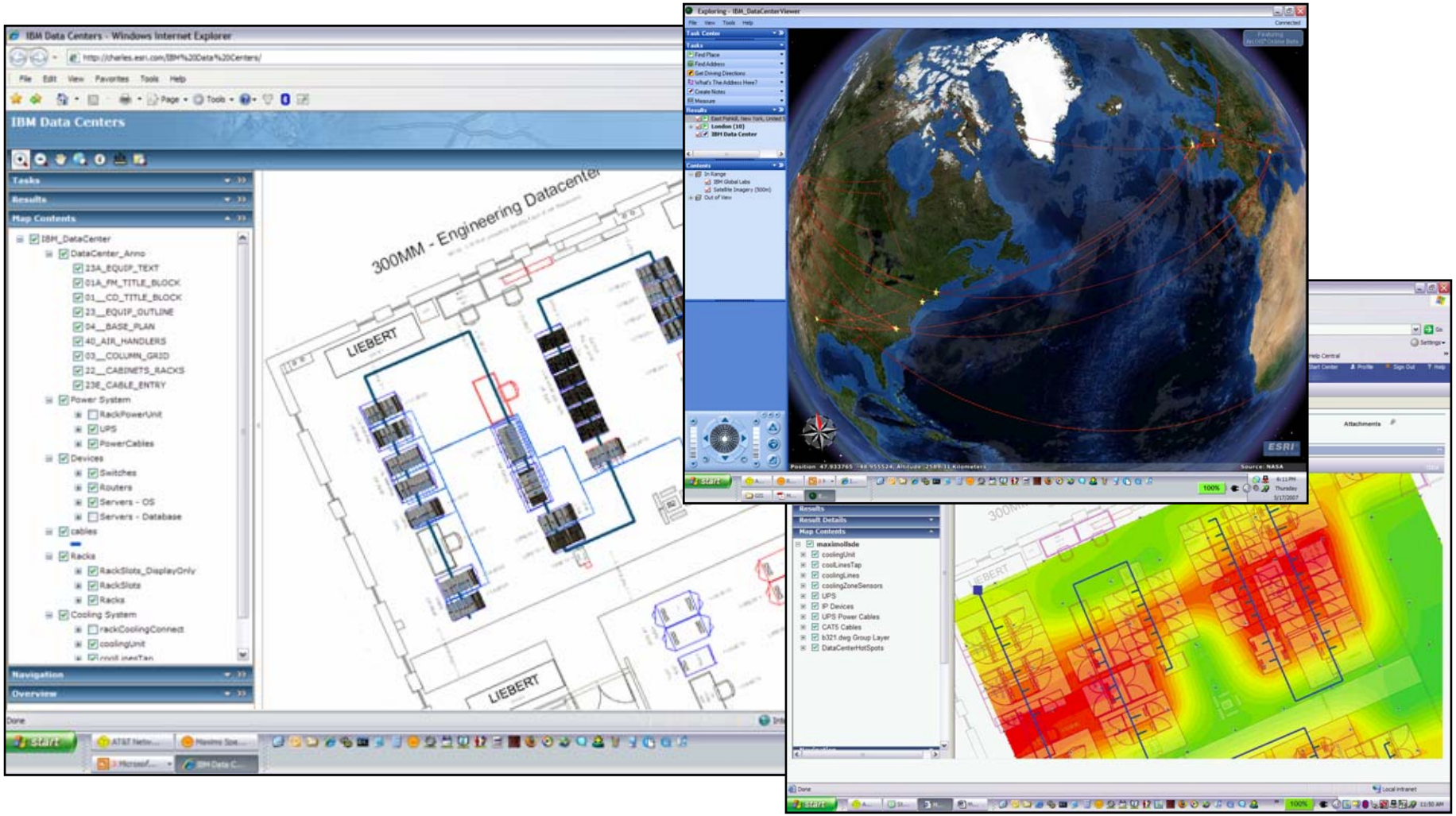
Efficiently manage the maintenance and pro active swap out procedures

Contract management with suppliers

Asset inventories, geo spatial detail and ownership information for compliance reporting

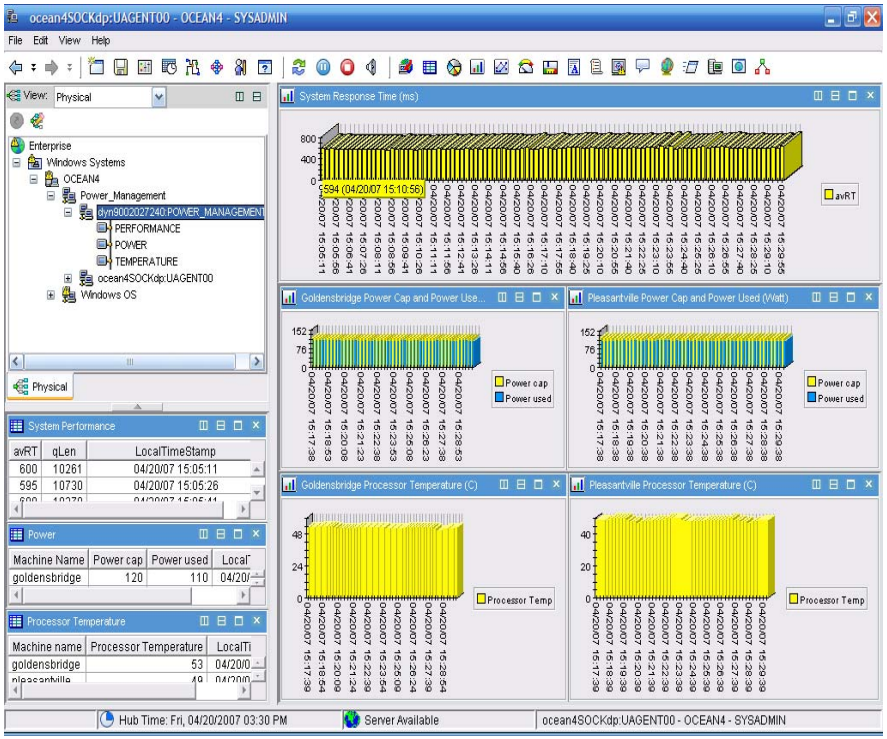
Manage incidents, problems, changes and configurations from a single platform

Geospatial integration for assets and data centres



Tivoli Monitoring for Green Energy

Now all your IT compute data plus all your facilities metrics in one spot ! ! !



Visualize the power consumption and thermal signatures of data center resources

Alert operators and facility managers before servers reach critical energy and temperature thresholds

Automate and control server's energy usage to optimal levels including triggers to 3rd party partners

New Partner Ecosystem Announced May 08:

vmware Johnson Controls t.a.c EATON APC by Schneider Electric OSIsoft. MatrikonOPC SIEMENS SYNAPSENSE

IBM

Energy Service Management Capabilities

Optimize your enterprise for energy efficiency

How much power am I using?

How much money can I save by reducing power?

What services are costing me the most in power consumption?

Can I change and still meet my service level agreements?

What should I do first?

Gain Visibility to Energy Usage

New energy Optimization reports included in ITM Tivoli Monitoring

Tivoli

IBM.

Data Center Power Usage

Period 1 Begin Start: Feb 1, 2008 12:00 am
Period 2 Begin Start: Mar 1, 2008 12:00 am
Period 1 Begin End: Feb 28, 2008 11:59 pm
Period 1 Begin End: Mar 31, 2008 11:59 pm

Information

Resource	Power Consumption		Cost		Carbon Emmission		CPU Utilization	
	Previous	Current	Previous	Current	Previous	Current	Previous	Current
Servers (120/120)	57,024	39,917	$ 6,273	$ 4,192	144	103	20%	25%
Storage (40/40)	109,085	81,813	$12,000	$ 9,000	275	211	N/A	N/A
Networking	72,723	58,173	$ 8,000	$ 6,400	183	150	N/A	N/A
Facilities	100,000	85,000	$11,000	$ 9,350	252	219	N/A	N/A
Total	**338,832**	**264,909**	**$37,273**	**$28,942**	**854**	**684**		

Power Consumption

Cost

Carbon Emmission

400 300 200 100 0

30 20 10 0

800 600 400 200 0

Servers
Storage
Network
Facility

Servers
Storage
Network
Facility

Resource	Peak Usage		Off Peak Usage		Weekend Usage	
	Previous	Current	Previous	Current	Previous	Current
AP Website Pool	1243	1012	4002	3994	3390	3912
NA/LA Website Pool	16432	8022	6203	7013	4114	4201
Intranet Pool	4204	3892	12032	5230	102	52
Development Pool	1390	1321	3789	1236	123	32
Total	**23269**	**14247**	**26026**	**17473**	**7729**	**8197**

30000 25000 20000 15000 10000 5000 0

AP Website Pool | NA/LA Website | Intranet Pool | Development Pool

Weekend
Off Peak
Peak

Track and trend changes in energy usage over time

Combine different data types and energy usage into a single report.

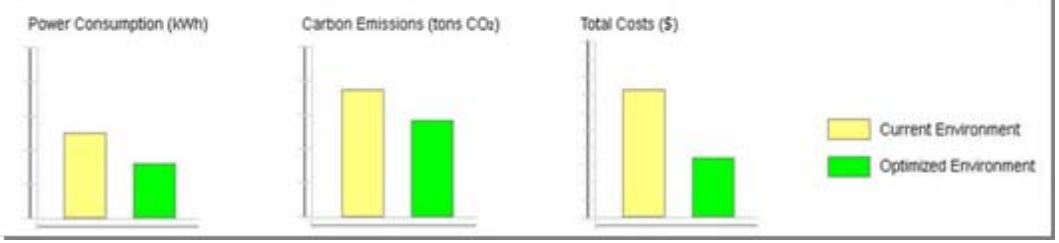
Obtain information needed to qualify for power company or government rebates and incentives

Advanced Control and Automation of the Data Center's Energy Usage

Tivoli IBM.

Data Center Power Usage and Expenditures

	Current Environment		Optimized Environment	
	Units	Costs	Units	Costs
Number of physical servers	150		45	
Server Power usage per year (kWh)	228,096	$ 25,090	122,864	$ 13,515
Associated Facilities power usage per year (kWh)	484,000	$ 44,000	411,400	$ 37,400
Carbon Emissions per year (tons CO2)	3874		2906	
Storage Infrastructure	1,090,933	$120,000	727,275	$ 80,000
Networking Infrastructure	727,289	$ 80,000	363,637	$ 40,000
Administration Personnel required per year	6	$480,000	2	$160,000
New hardware / upgrades needed			4	$ 8,000
OS Licensing per year	150	$ 15,000	45	$ 4,500
Virtual Machine Software per year			30	$ 4,500
Other Software			45	$ 4,500
Total per year	**2,530,318**	**$764,090**	**1,625,176**	**$352,415**

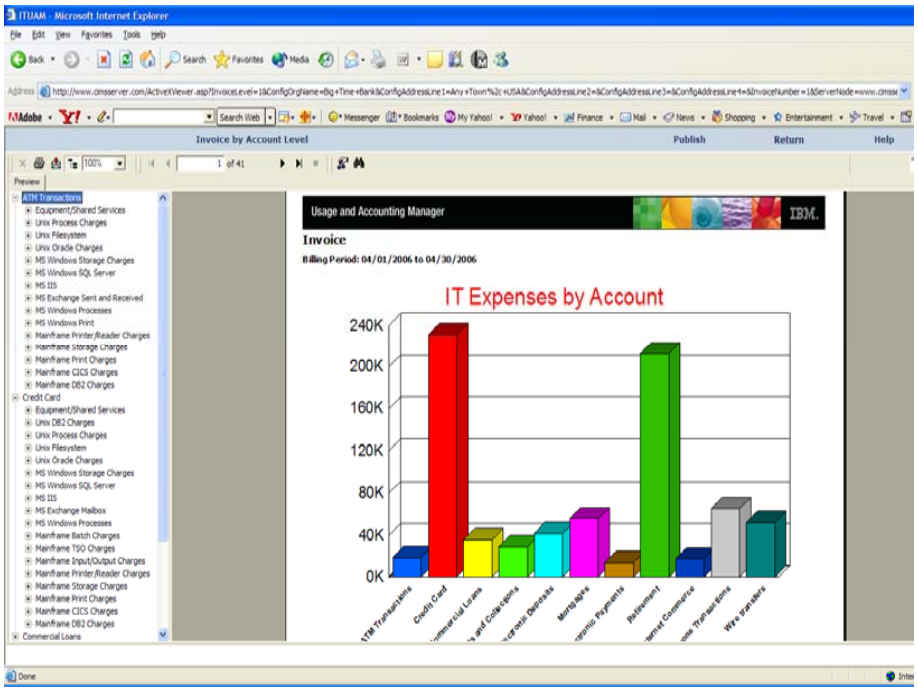


Compare current power utilization and costs to the optimal configurations

Model incremental changes to analyze how the data center environment will change

New energy Optimization reports included in ITM Tivoli Monitoring

Chargeback of resources including energy used, plus power and thermal trends.



Who used what?
How much did it cost?
Usage based accounting & chargeback

Aggregate power consumption data and determine cost of power via ***Tivoli Usage and Accounting Manager***

Set a benchmark for energy usage to better track improvements

Report on the amount of power consumed, when it was consumed, and which services consumed it

Introduce power utilization accountability

Integrated Role-Based Dashboards

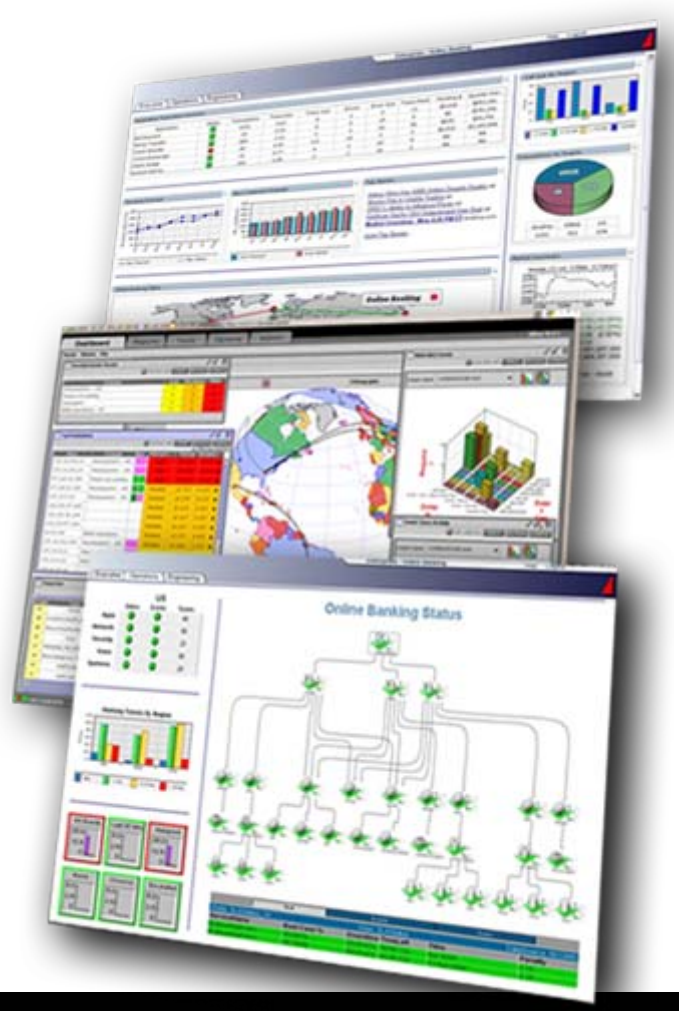
Enabling better & faster decisions across all operational areas of the Data Centre

Different roles have different informational and operational requirements.

UI integration strategy focused on dashboard and portal requirements of common operational organizations:

- IT Operations
- Service Provider
- Business Operations
- Storage Management
- Security Operations
- Energy & carbon dashboards
- Common reporting

Delivers appropriate data and capability to different operational and business audiences.



Tivoli ‘Green’ Service Management

An Integrated Approach to controlling energy costs

Visibility

See your business

Provide unified views of data center resources, IT services, and costs in the context of energy

Control

Manage risk & compliance

Establish policy-based management to ensure efficient use of available resources and capabilities while maintaining service levels

Automation

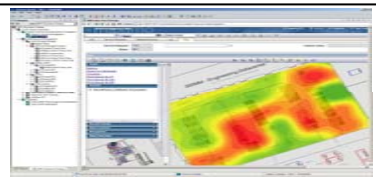
Build agility into Operations

Implement closed-loop monitoring and management to ensure optimal power consumption as workloads vary across business cycles.

IBM Service Management's Green Data Center

Using Green Data to accent Tivoli's existing event architecture and data model

Green Business Services



Optimize Assets by Energy Usage

Tivoli Monitoring for Green Energy

Intelligent Chargeback

Energy Aware Provisioning

Tivoli Energy Efficient Data Centre Value

Visibility

- Visualisation, reporting, trending, dashboards
- Discovery, mapping, configuration management
- Integration between IT and Facilities
- Usage, accounting and chargeback

Control

- Performance and availability monitoring and optimisation
- Virtualisation provisioning and management
- Enterprise asset lifecycle management
- Security management and governance

Automation

- Dynamic workload management
- Active energy management
- Information lifecycle management
- Application lifecycle management

Some examples …

saving money, space, energy, carbon

Virtualise - IBM Global Infrastructure

Improve operational efficiency and risk management while reducing energy usage by 80%

Client requirements

- Needed to reduce systems management complexity
- Needed to increase stability, availability, and provide world-class security
- Improve operational costs and energy efficiency

Solution

- Consolidate 3,900 servers to 33 System z mainframes
- Migrate servers delivering largest savings first
- Eliminate assets with lowest utilisation first
- Aggregate by customer work portfolio to leverage strong customer buy-in
- Focus on freeing up raised floor space (30xoffice cost)
- Provision new applications to the mainframe

Benefits

- Annual energy usage reduced by 80%
- Total floor space reduced by 85%

Tivoli

DB2

Lotus

WebSphere

SAP

Initial priority for consolidation to Linux on System z

Virtualise – Rationalization at UPMC

Maximize service level and mitigate costs by saving $18-22M over 3 years with Wintel, Unix and storage virtualization

Client requirements

- **Server growth 4x in 5 years – data center chaos**
- **Centralize IT services and consolidate data centers**
- **Free up space to produce revenue – more hospital beds**

Solution

- **Wintel and Unix virtualization**
- **Reducing from 40 storage databases to two centralized SAN arrays**
- **Consolidating 1,000 physical servers to 300 IBM servers (multiple platforms)**

Benefits: $18-22M savings over 3 years

- **Virtualization saved $9.8M in first five months**
- **Utilization rates increasing from 3% to 80% per server**
- **Server capacity increase by 150%**
- **Maintained flat infrastructure support staff**
- **Create hospital space**

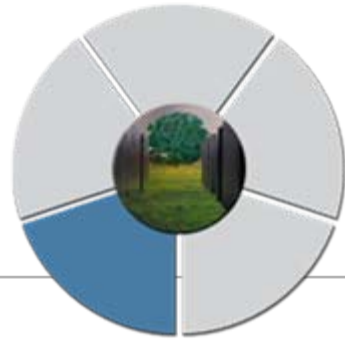
UPMC | University of Pittsburgh Medical Center

"These accomplishments help position UPMC as a leader in the adoption of server virtualization technology among health care provider organizations…will fundamentally alter how IT is deployed and managed in the industry"

- Health Industry Insights, IDC, January 2007

Virtualize - IBM Data Center

Improved operational costs up to 70% with aggressive distributed platform virtualization



Client requirements

Improve IT equipment utilization
Reduce IT hardware requirements

Solution

Advanced POWER Virtualization (APV) and VMWare
Reduced number of physical servers

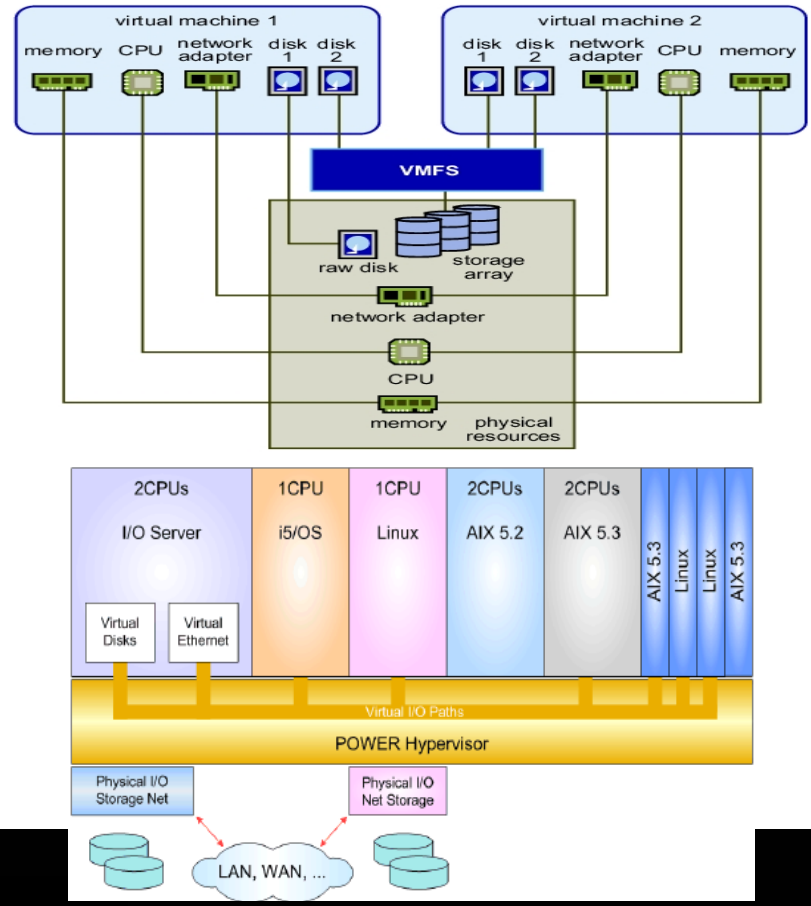
- Wintel from 11,000 to 1,500
- Unix from 8,500 to 1,500

Three times improvement in server utilization
Formed a Virtualization Center of Excellence to implement best practices across geographies

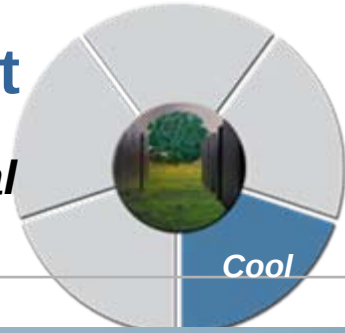
Benefits

Operational savings of up to 70%

- Space, power and cooling, maintenance, software support and personnel costs



Cool - Data Center Stored Cooling - IBM Bromont



Implement innovative cooling technology to reduce operational costs from the largest data center energy user by 45%

Client requirements

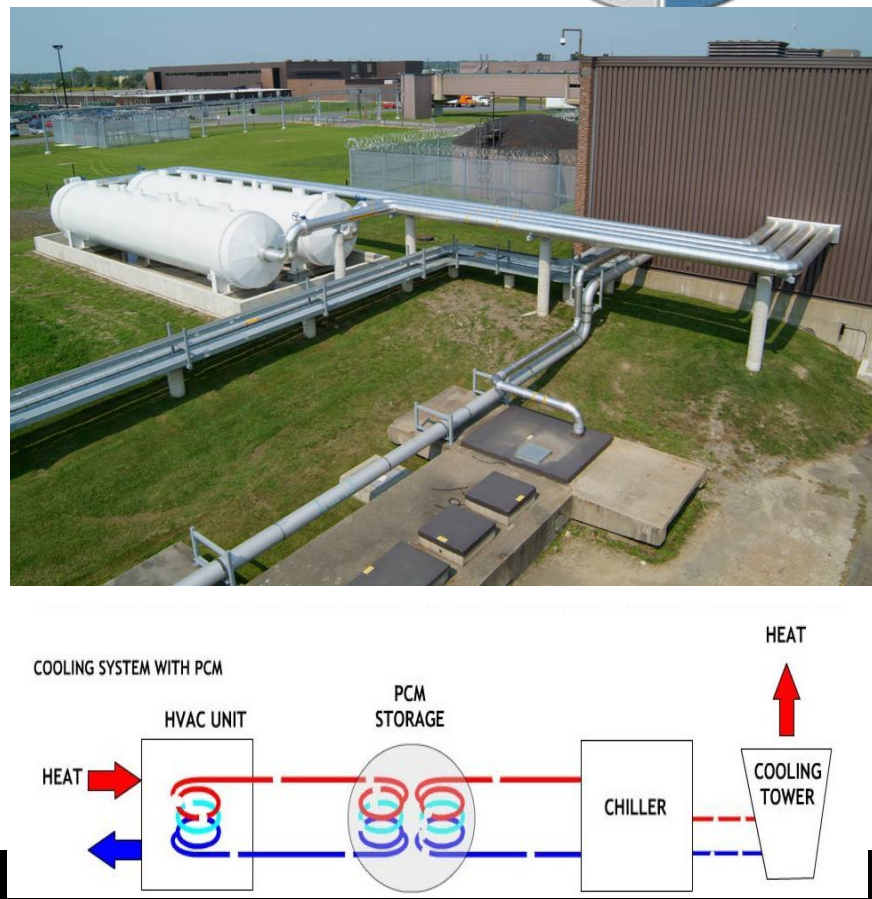
- **Identify and attach the largest areas of energy consumption**
- **Reduce energy consumption and operating costs of chiller plant supporting Bromont (Quebec, Canada) site**

Solution

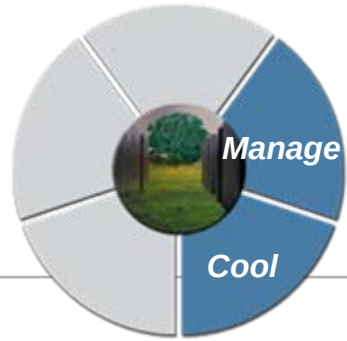
- **Install "Cool Battery"**
- **Increase chiller utilisation by storing cold for use throughout the day**
- **Leverage environment - free cooling**

Benefits

- **Reduced chiller plant energy cost by 45%**
  - Over 5.3 million kwhr per year
  - Demand reduction of approximately 1 MW
- **Avoided need to install additional chiller**
- **Environmentally-friendly, non-toxic, no-maintenance**



Manage, Measure & Cool - IBM Southbury



Implement IBM Energy Management Solution and IBM Rear Door Heat eXchanger for 10-30% energy savings

Client requirements

- Improve how to meter, control, and cap power usage
- Actively moving workloads and power up/down resources

Solution

- Power density of 200 watts per square foot
- Use of 2-3 “Thermal Zones” for targeted power and cooling
- Power and thermal meters to measure baseline and changes
- Rack based thermal cooling

Expected Benefits

- Integrated Facilities and IT solution
- Rack Level Cooling Improves Efficiency 20-30%
- Match Cooling Load to Heat Load: 10-30% Savings
- Combined Air and Water or Refrigerant Cooling
- Reduces Equipment Costs/More Flexible Facility

IBM PowerExecutive

Energy Efficient Data Centre Summary

Measurement - Holistic integration of IT and Facilities assets and energy

Visibility – Real-time, integrated, role-based operational and business dashboards

Control - Active energy management within business service context

Automation - Dynamically adapting environment based on optimised service, energy and demand

Exploit - Innovate with technology across the business to reduce [the other 98%] carbon emissions

Managing the New Enterprise Data Centre

Nicholas Drabble

Green Computing Programme Manager

IBM Software Group – UK, Ireland

Tomorrow's Data Centre June 2008