IBM and GREEN IT

NG KIEN LOCK

Let's build a smarter planet.

Today's Agenda

- Developing a GREEN agenda
- GREEN Collaboration
- GREEN Data Center
- Virtualization
- GREEN Networks
- Call to GREEN Action
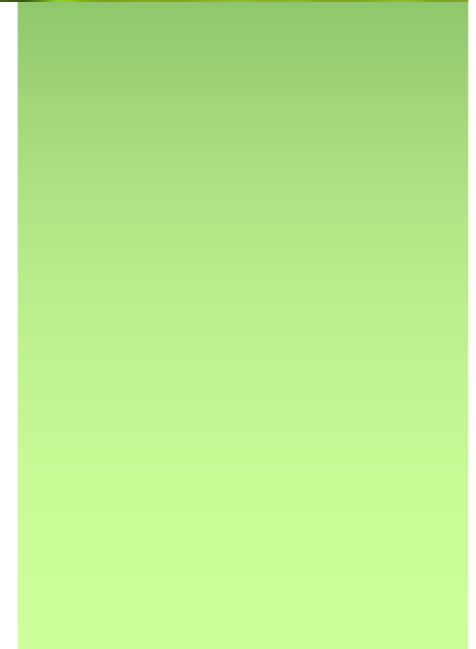
It is only through
the ability to
share and promote

innovation

that we can tackle the environmental
issues facing us

Key Messages

- **Energy efficiency** is a global issue with significant impact today — and will have an even greater impact in the future

- Data center design must change – technology and business growth uncertainty and rising costs drive the need for a **new approach**

- Energy efficiency is a key metric to evaluate **overall IT operational efficiency**

- Immediate financial return can be realized by **optimizing around energy efficiency in current data centers**, while planning for the future

- Many have realized the **benefits** of going green, start now.

Think **Green**: *What is the role of the CIO?*

What is your choice?

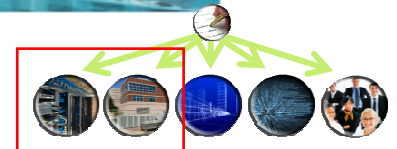*50% of CFO's have reducing data center power as a priority[4]*

Five building blocks provide the tools to operational savings and business growth.
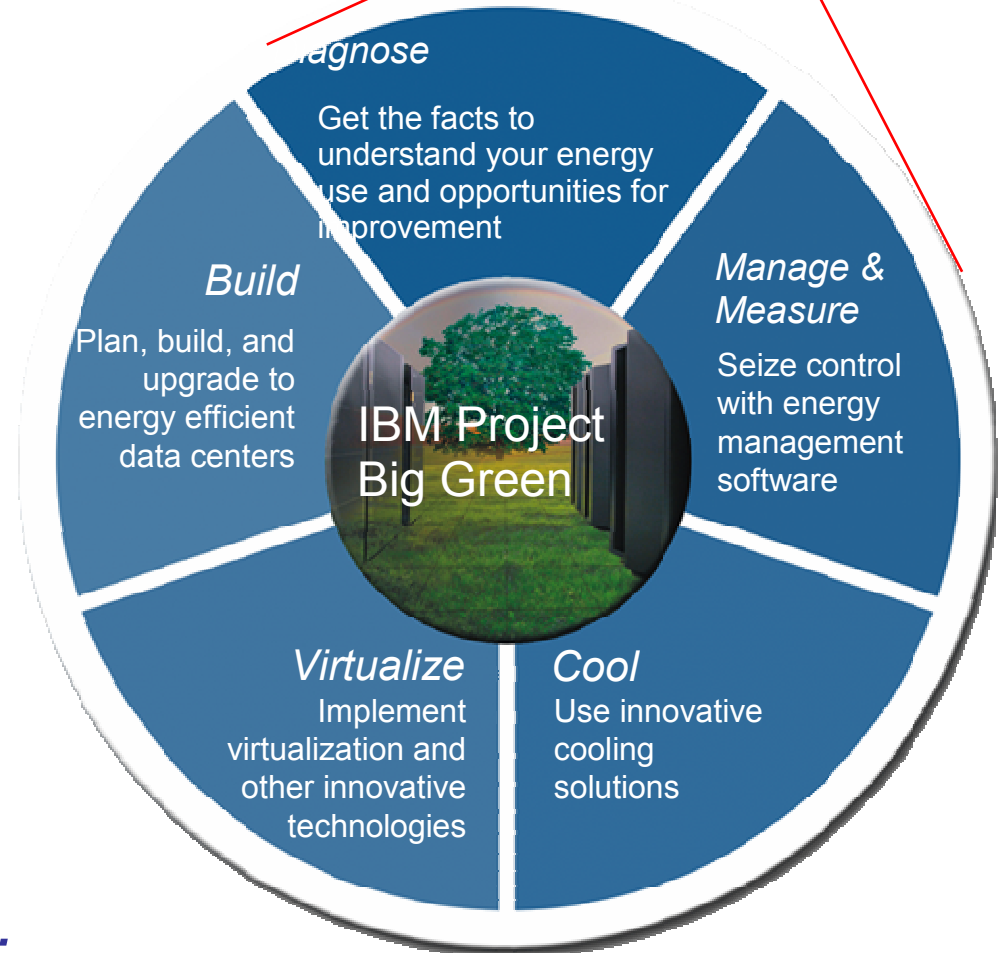
Double your IT capacity
- In the same energy footprint

Reduce operational costs
- 40-50% energy savings
- *$1.3M / yr savings*

Positive environmental impact
- *1,300 less cars or 3.5M less pounds of coal*

Going green impacts the pocketbook and the planet.

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

Build
Plan, build, and upgrade to energy efficient data centers

IBM Project Big Green

Manage & Measure
Seize control with energy management software

Virtualize
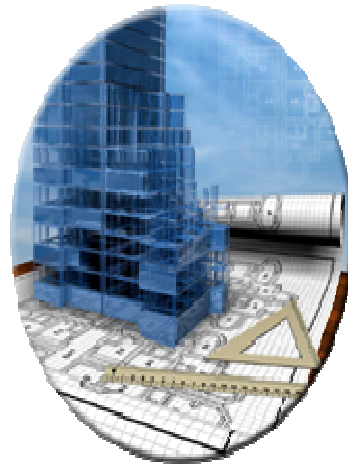Implement virtualization and other innovative technologies

Cool
Use innovative cooling solutions

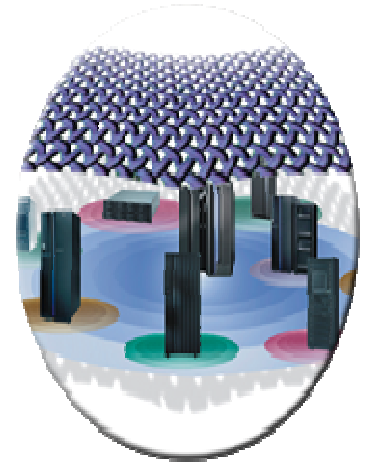# IBM's Holistic **Green** IT Approach

Diagnose

Facilities

Compute Resources
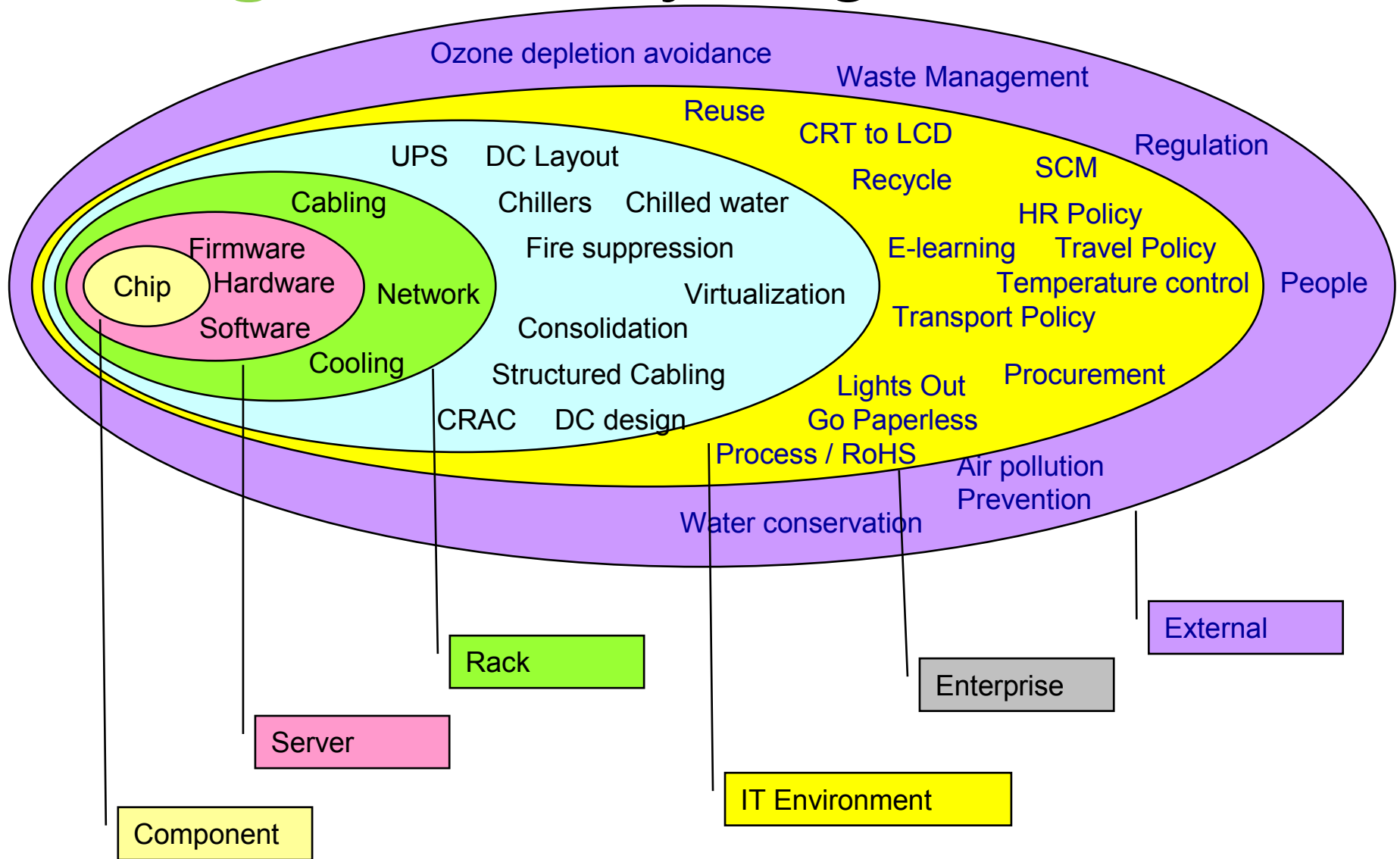
Virtualization

Active Energy Management

Cooling Innovations

Responsible Disposal

Let's build a smarter planet.

IBM

How **green** can you go?

Ozone depletion avoidance

Waste Management

Reuse

CRT to LCD

Regulation

UPS   DC Layout

SCM

Recycle

Cabling

Chillers   Chilled water

HR Policy

Firmware

Fire suppression

E-learning   Travel Policy

Chip   Hardware   Network

Virtualization

Temperature control   People

Software

Consolidation

Transport Policy

Cooling

Structured Cabling

Procurement

CRAC   DC design

Lights Out
Go Paperless

Process / RoHS

Air pollution
Prevention

Water conservation

External

Rack

Enterprise

Server

IT Environment

Component

Establishing Your **Green** Agenda

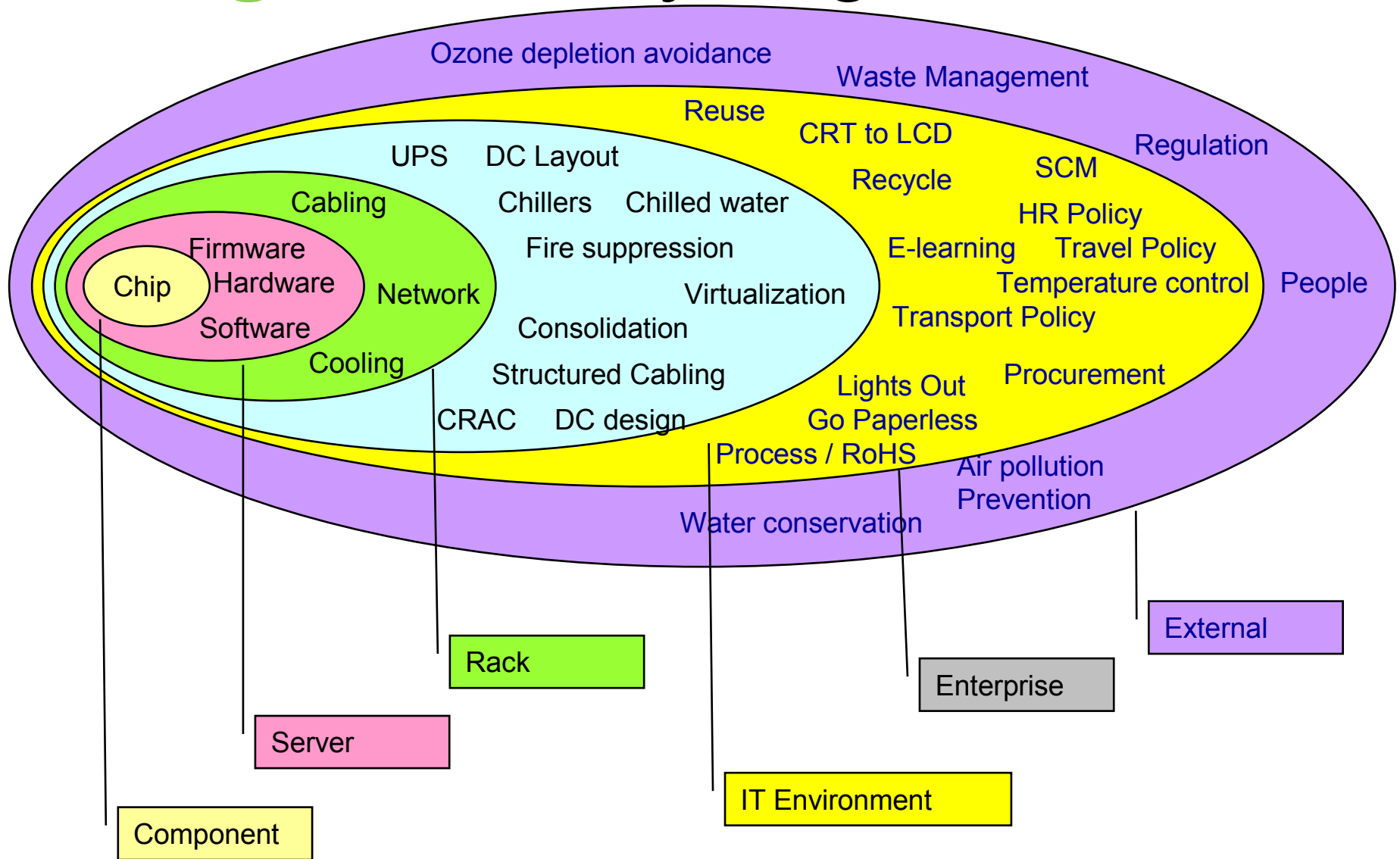*Setting, achieving, measuring and verifying requires your holistic approach.*

Systems and data center equipment

Facilities

Infrastructure service management

Workload

People

GREEN COLLABORATION

Let's build a smarter planet.

IBM

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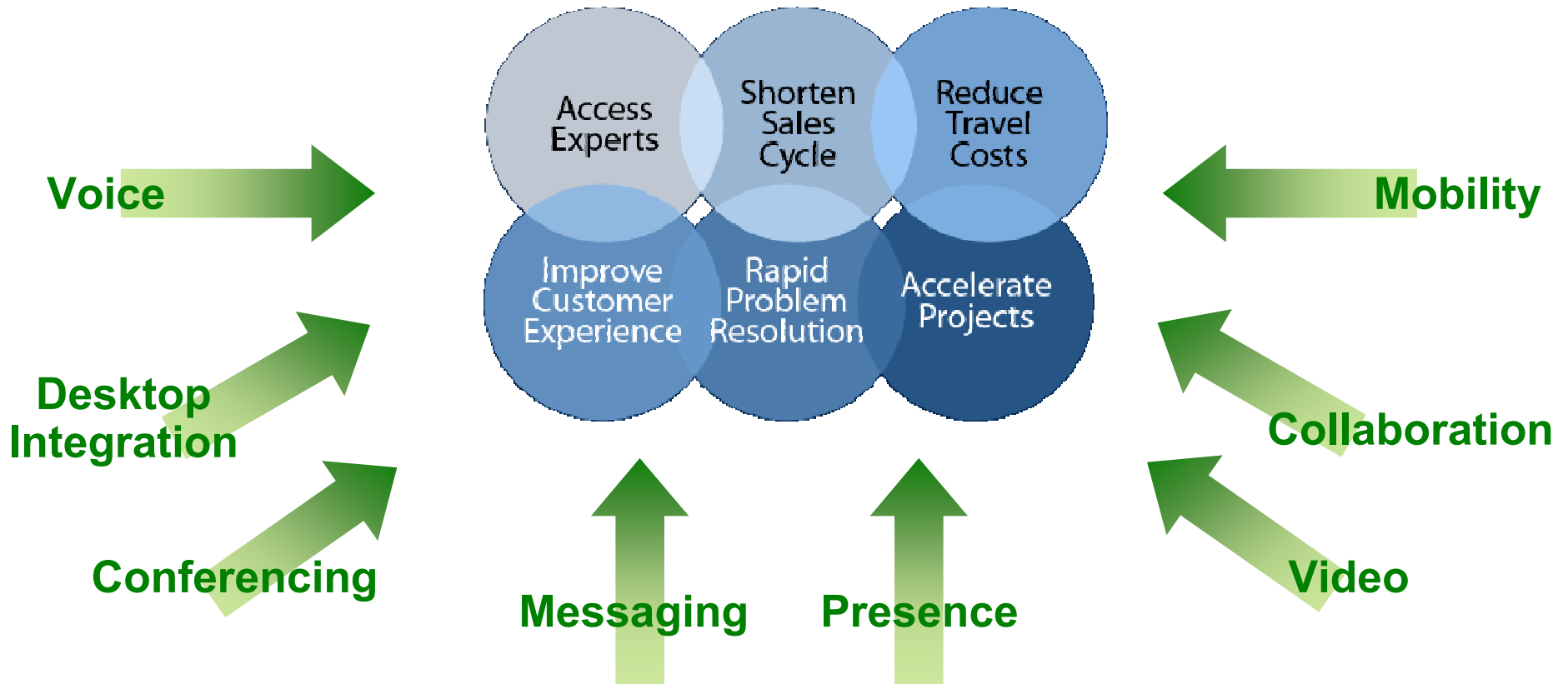
Component

Optimizing Infrastructure, Workloads and People for Energy Efficiency

Let's build a smarter planet.

IBM

People

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

Comply with environmental regulatory requirements

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

Optimize business processes to reduce energy footprint and costs of operations

Turn the power down when work (transactions) slows down

Compress your data to lower storage and server needs

Reduce commuting with online collaboration and increasing work from home

Reduce business travel by using online collaboration

Workloads

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

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

Optimize applications to reduce needed IT resources and energy

Infrastructure Service Management

Consolidate and Virtualize to eliminate floor space and compute infrastructure

Optimize HVAC for hot spots to reduce energy consumption

IBM Going Green - The benefits of collaboration tools

"Going Green"

$16.5 million saved per year in reduced phone costs from use of instant messaging

$97 million saved per year in travel costs from use of Web conferencing

Globally dispersed employees feel part of a
collaborative community

Flexible options (IM, Web conferencing, VoIP) give users the freedom to choose the mode by which they communicate

Costs are down…customer *satisfaction* is up…people are *more productive*

Today, nearly 1/3 of IBM's global work force (over 100,000 employees) participates in work-at-home or mobile-work programs

Sample footprint reduction in US:
– 8 million gallons of fuel conserved and more than 61,600 metric tons of CO2 emissions avoided in 2006
– 3,600 metric tons of CO2 emissions avoided in same year by US employees using alternative commute programs such as carpooling

In Europe:
– 50% reduction in energy used per employee at an office complex
due to more efficient office designs
– Savings of 30,000 megawatt-hours per year
– $2.8 million reduced annual energy expenditures in Austria, Germany and Switzerland
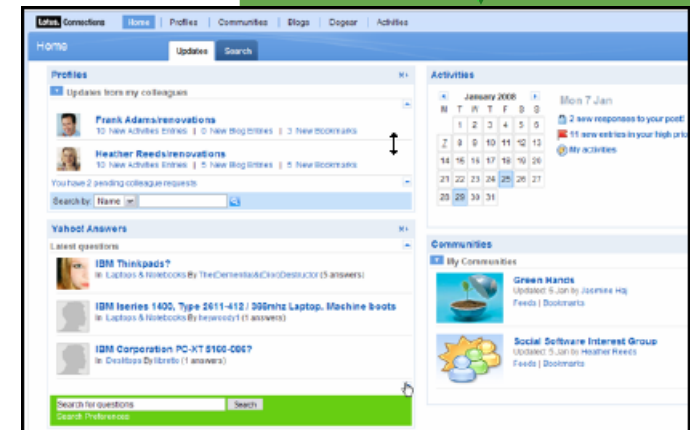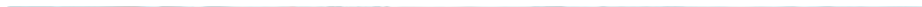
GREEN DATA CENTER

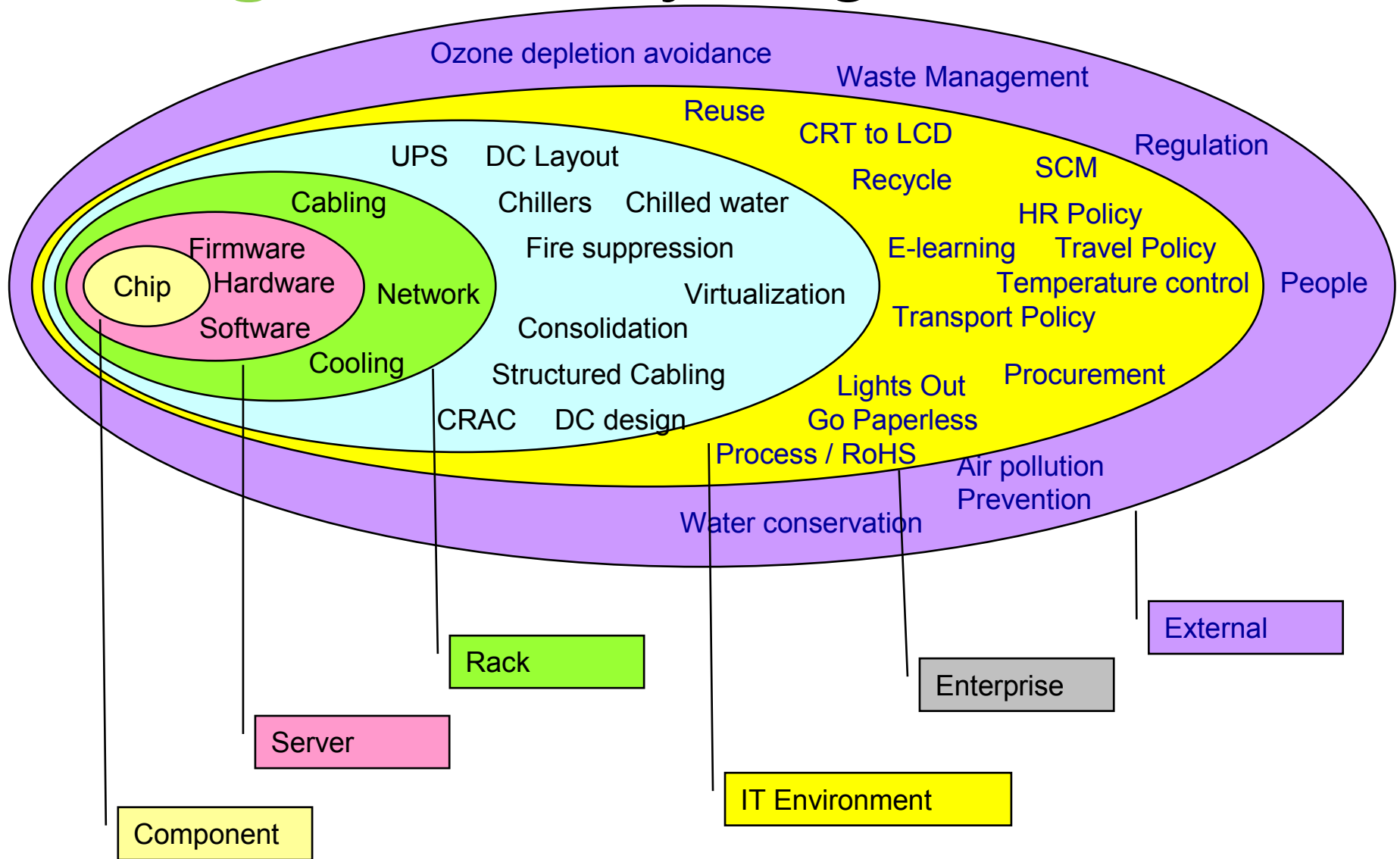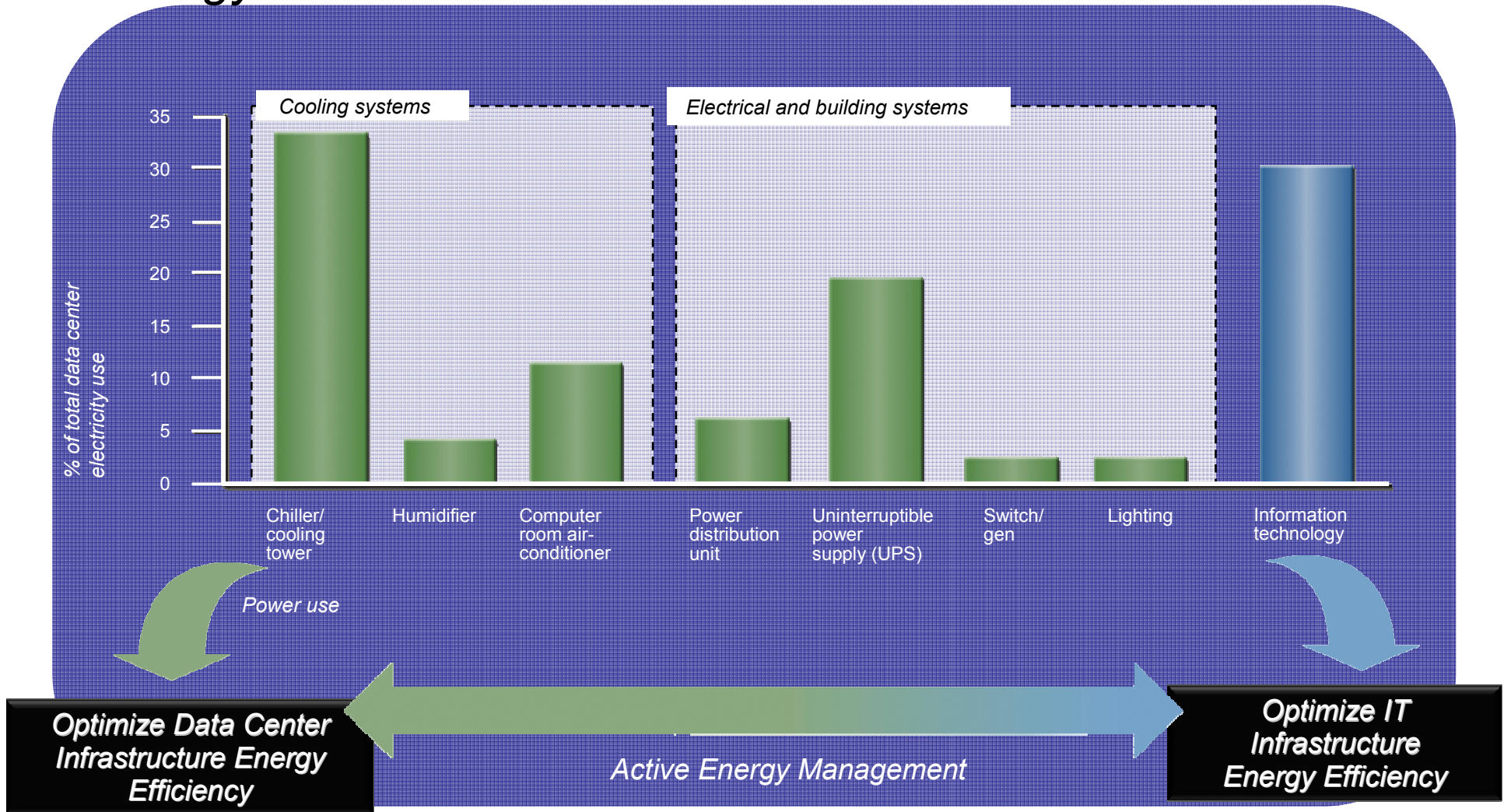# Inherent Data Center Inefficiencies

- Data Centers are **over-planned**

  - To provide 24X7 availability

  - Allow for unpredictable future growth

  - 90% of corporate Data Centers have more cooling capacity than required

- Historically, **inefficient** equipment deployments

  - Server under utilization, one application per server

  - 72% of cooling bypassed the computing equipment entirely

- Understanding **Usage**

  - Using DC Space to support command center, DC-Control Room, Storage, Media-Control…etc

- Custom design/layout and no overall **control**

  - As and when required, unable to measure and hence unable to control

- Human Traffic

  - 70% of DC problem - **human error**

Cooling, Power and IT are the 3 largest consumer of energy in a data center

Cooling systems

Electrical and building systems

% of total data center electricity use

| 35 |
| 30 |
| 25 |
| 20 |
| 15 |
| 10 |
| 5 |
| 0 |

Chiller/cooling tower | Humidifier | Computer room air-conditioner | Power distribution unit | Uninterruptible power supply (UPS) | Switch/gen | Lighting | Information technology

Power use

Optimize Data Center Infrastructure Energy Efficiency

Active Energy Management

Optimize IT Infrastructure Energy Efficiency

Data centers are at a tipping point, driven by energy costs and usage

Increased Compute Demand

- Server growth 6x, Storage growth 69x this decade[1]
- By 2011, blades will represent 26% of all server shipments[2]

Changing cost dynamics

- Data centers energy use doubling every 5 years[3]
- New data center construction costs are increasing - $30 to $50M for a 20K square foot data center
- Operating costs = 3x capital costs over 20 years

Data center lifecycle mismatch

- 78% of data centers are > 7 years old[4]
- Technology densities are growing 20x this decade[5]
- 33% of managers expect data centers to last 30 years[6]

Meet Business & IT Growth

Reduce capital and operating costs for data centers

Reduce risk by providing more available and predictable data center operations

1. IBM and Consultant Studies
2. IDC Worldwide Blade Server 2008-2011 Forecast, February 2008, IDC #210229
3. Koomey, February 2007.
4. Gartner Survey Suggests Extensive Data center Expansion plans on the Horizon, G00154962, mike Chuba, February 200
5. ASHRAE (find source)
6. IDC The datacenter evolution: Technologies, Designs, People and Green, Michele Bailey, 2008

Many data center projects happen because of the following business reasons

- Data center consolidation
- Data center relocation
- Data center optimization/enhancement
- Data center expansion (space)
- Capacity upgrade (power, cooling)
- Enhance security
- Enhance performance
- Cost optimization

It is the not obvious that 'kills'. For every dollar spent procuring the data center, four dollars are spent operating it.

- Project management
- Migration
- Relocation
- Consolidation
- Virtualization

- Utilities
- Maintenance
- People costs
- Trouble shooting
- Governance
- Monitor
- Measurement

- Capacity planning
- Security

- Process
- Down time
- Human error

- Adds/Moves/Changes
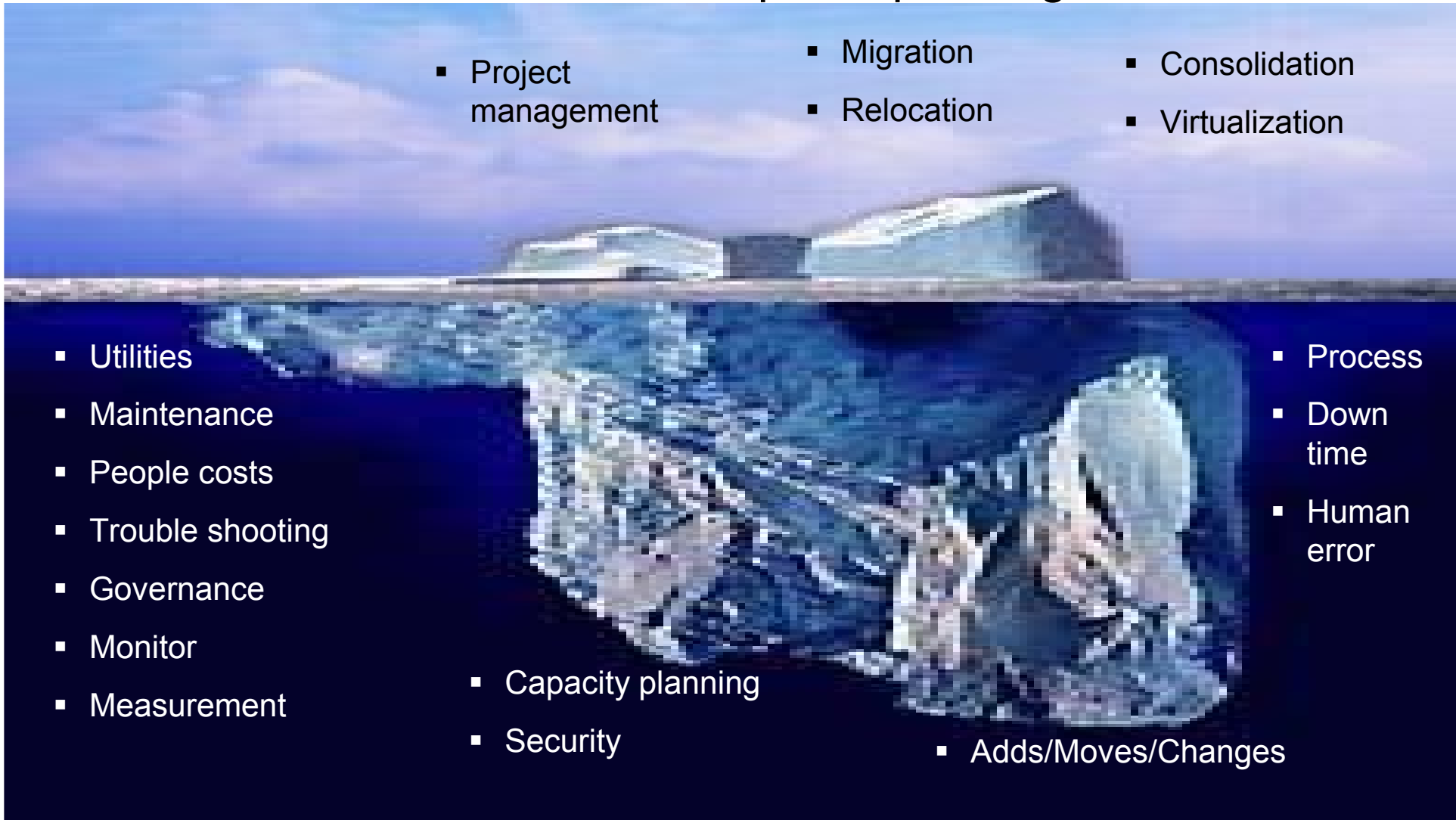
Resilience is the capability of an enterprise to rapidly adapt and respond to any internal or external unexpected event or sudden market change and continue business operations without significant disruption.

Resilient Data Center

Flexible

The infrastructure adopts to dynamic and unforeseen changes in the business environment.

Available

The infrastructure is prepared for threats from the inside and outside caused by technical influences, human beings and force majeure by means of proactive concepts.

Robust

The infrastructure reacts to changes and stress with consistent, adequate availability and security.

Rising Business Service Delivery Costs

Data Center

IT Load

55% 45%
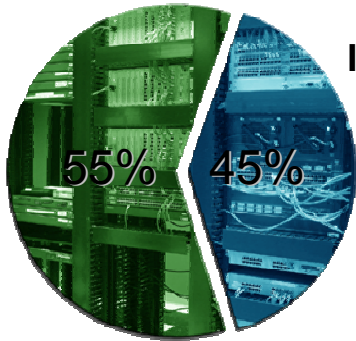
Power and Cooling

IT Resources

Processor

70% 30%
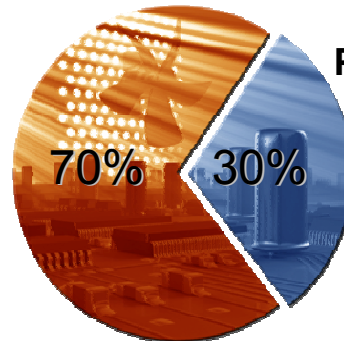
Power supply, memory, fans, drives . . .

Utilization

Used

80% 20%

Idle

27 W data center power

x1.7

16 W IT power

x3.3

5 W processor power

x5

+1 W used resource
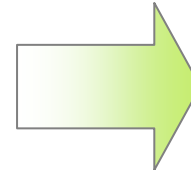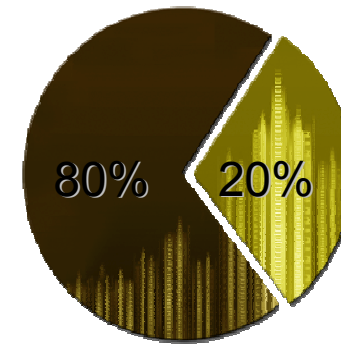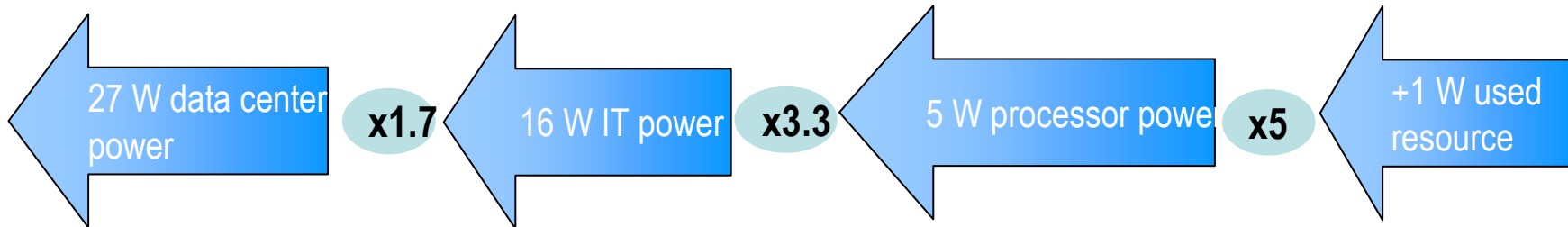
1W of application computing requires 27W of Data Center power

Five building blocks provide the tools to operational savings and business growth.

Double your IT capacity

- In the same energy footprint

Reduce operational costs of a 20,000 sq ft Data Center

- 40-50% energy savings
- *$1.3M / yr savings*

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Seize control with energy management software

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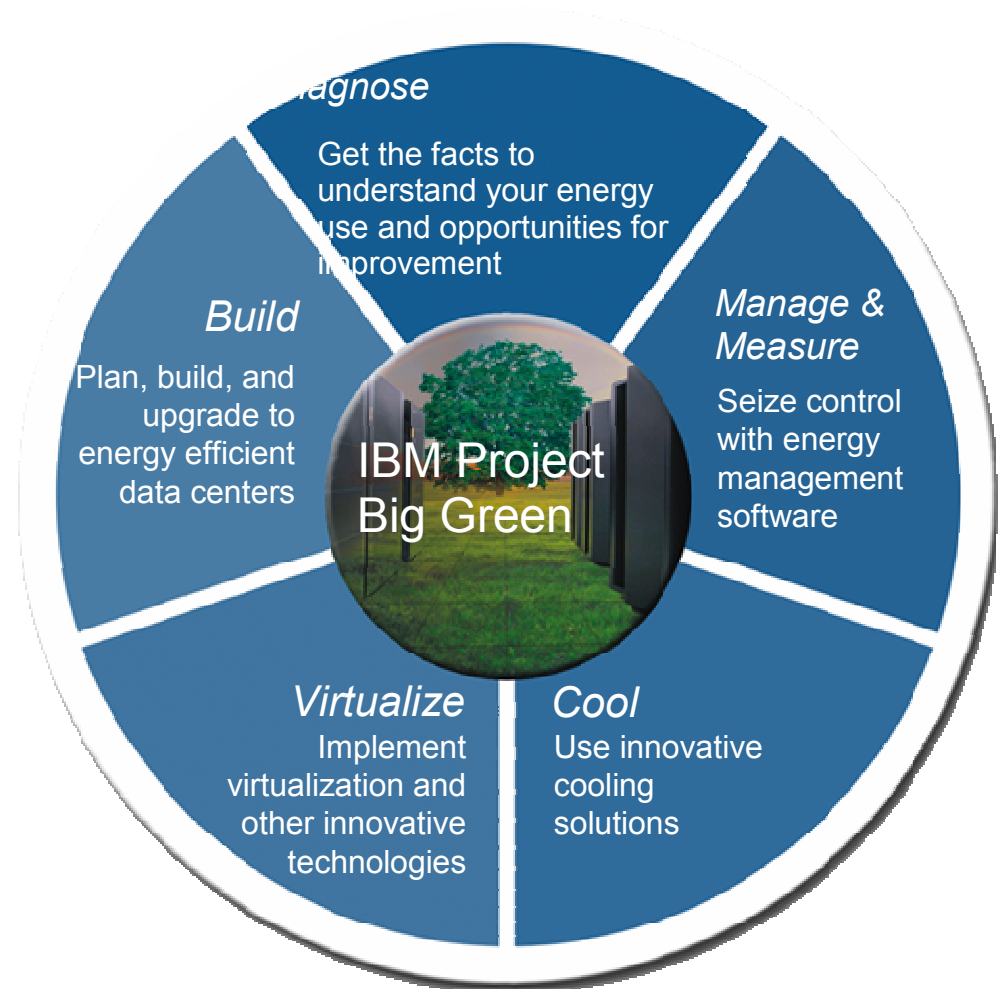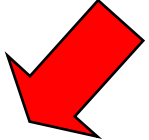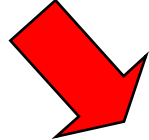
It's not what you **KNOW**, but what you **DO** that matters

Steps for creating a **green** data center

- Existing data center
  - Energy efficiency assessment
  - Optimize efficiency with short and long term solutions
  - Virtualize / consolidate your IT
  - Use advanced technologies
  - Measure and monitor savings

- New data center / expansion
  - Design it right at the beginning
  - Use advanced technologies
  - Modular approach
  - Consider holistic/integrated approach (IT, racking, cabling)
  - Use thermal modeling

IBM assesses the client's data center's energy efficiency

- Data center energy efficiency assessments from IBM can help the client understand their energy use and identify measures to help improve energy efficiency by providing:
  - An assessment of the energy usage of the cooling, electrical and building systems that support the IT equipment
  - Identification of opportunities to improve energy efficiency that can:
    - Reduce costs
    - Free up power for use by IT equipment
  - High level business-case financial justification for efficiency improvements based on potential energy cost savings, prioritizing potential investments
  - Comparison to a data center energy efficiency standard
- Benefits from an assessment
  - Potential for 15 to 40 percent savings on the infrastructure electric bill

IBM Data Center Solution Overview

Traditional DC Services (BAU) + Project Big Green = Robust + Available + Flexible + Energy Efficient

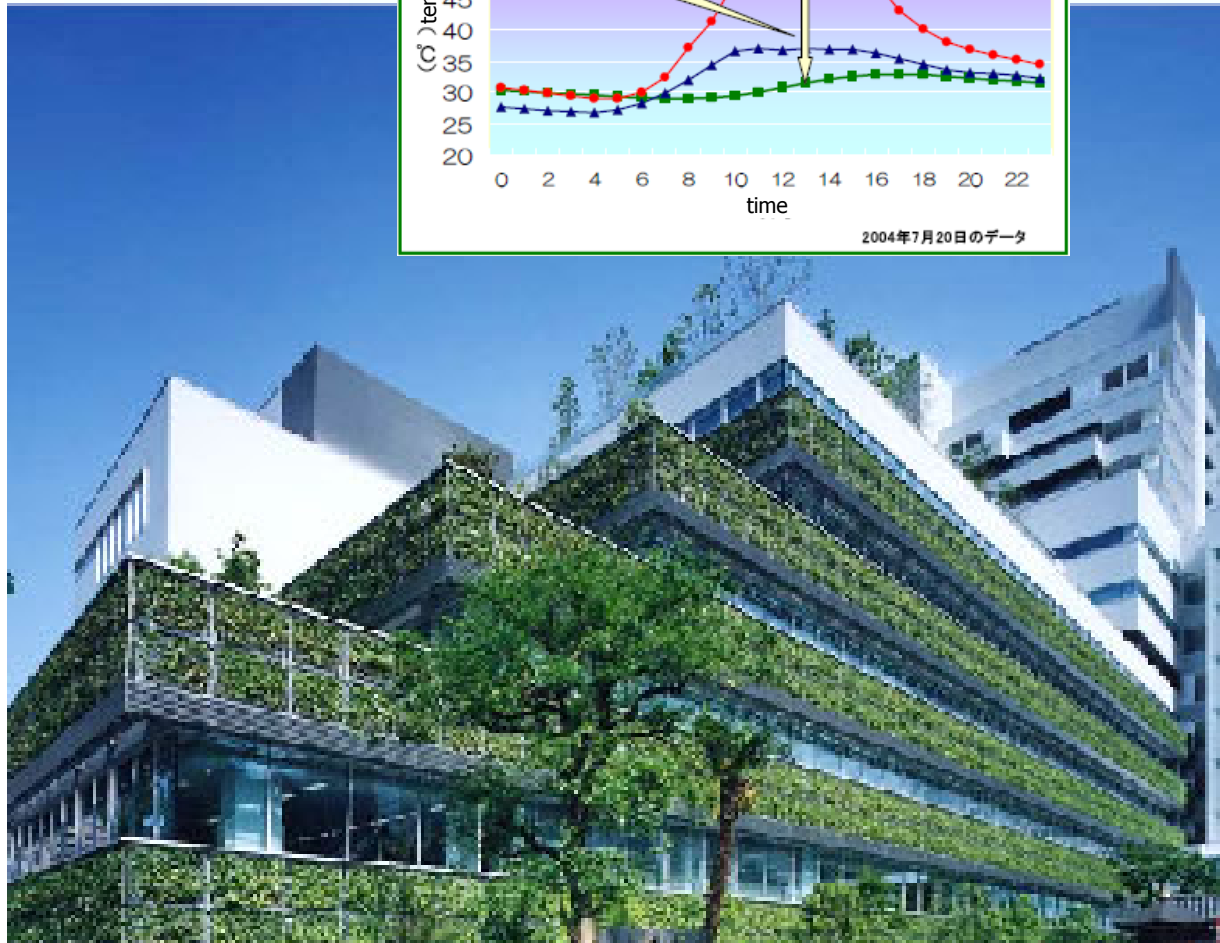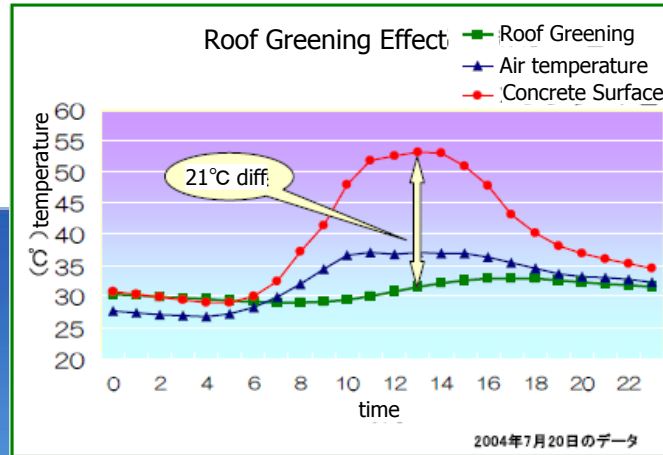# Data center consolidation: challenges and benefits

- Combining multiple data centers into a few centers typically:
  - Aims to simplify infrastructure and maintenance, save money, and enhance security and compliance
  - Relocates equipment—but leaves users widely dispersed
  - Loses effectiveness if users experience application latency
  - Is expensive—and won't overcome latency—if it requires adding bandwidth

- Consolidation becomes effective when it can:
  - Maintain LAN-like service for remote users
  - Help mitigate the risk of consolidating multiple complex data centers
  - Help integrate the data center with branch infrastructures—including multivendor environments
  - Reduce the need to increase expenditures on WAN bandwidth
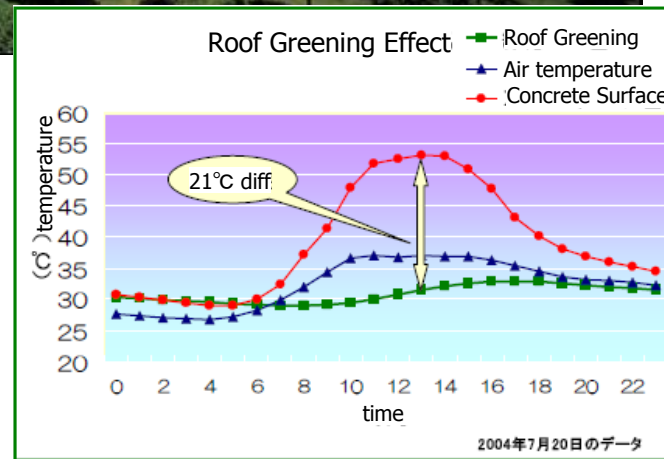
Wall Greening

Roof Greening

1. Reduce PAL
2. Reduce CEC

Roof Greening Effect
- Roof Greening
- Air temperature
- Concrete Surface

21℃ diff

2004年7月20日のデータ

Acros Fukuoka

Control/Seal Penetration (Heat/Vapor)

Double Skin

Sunlight = 100

convection

Energy enters the building

Outside

4

81%

77 inside

19

emission

No sun shading

Sunlight = 100

convection

Energy enters the building

Outside

8

18%

10 inside

82

emission

With sun shading (outside)
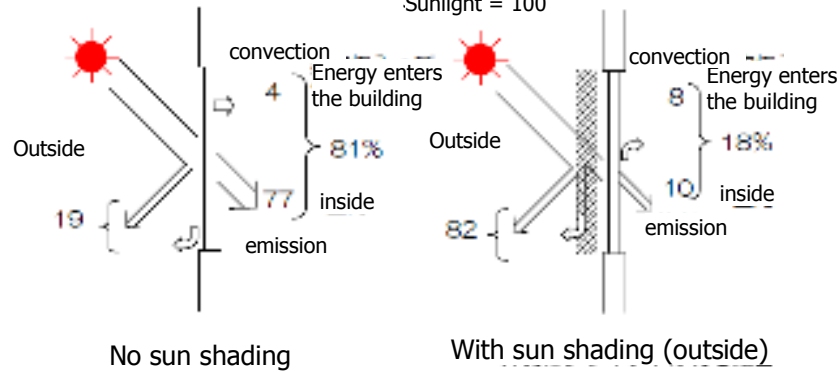
Mabuchi Motor HQ Building

Assessing energy efficiency: helping client's apply power and cooling best practices

IBM provides a comprehensive, fact-based analysis that prioritizes tactical plans across your data center to help improve efficiency and reduce costs
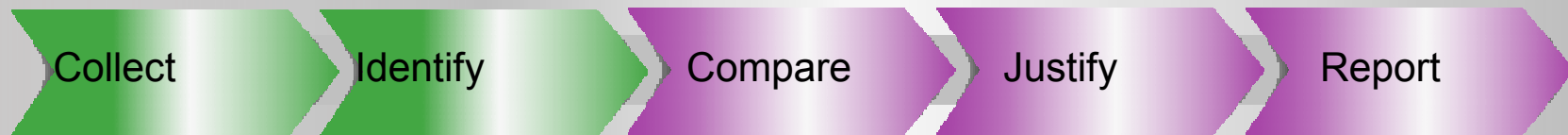
Collect	Identify	Compare	Justify	Report
Get the facts	**Find the gaps**	**Measure against standards**	**Estimate ROI**	**Project expected improvement**
• Current energy usage • Power consumption by component • Operating procedures	• Infrastructure (in)efficiencies • Energy management incentives • Efficiency improvement options	• Comparison of total power to power used by IT • Marketplace compensation • Range of improvement	• Estimate cost returns • Prioritize projects based on return on investment (ROI) • Estimate energy bill savings	• Estimate expected energy savings • Demonstrate expected efficiency improvements • Support applications for data center energy efficiency incentives • Support environmental reporting • Provide next steps for implementation of improvement projects

Six- to eight-week effort, depending on availability of site-specific data and site access

Green Data Center using new design & technology

- Benefits
  - Quick to deploy (8 – 12 weeks)
  - Lower implementation costs (up to 20% lower)
  - Lower operating costs (up to 40% lower)
  - Energy efficient
  - Scalable to easily meet the needs of today and tomorrow
  - Space saving (up to 40% less space)
  - Modular design for quick easy maintenance and growth
  - No raised floor required
    - Flexible installations
    - High denisty zones
  - High density computing environment support
    - Up to 30kW per rack and higher
    - Preconfigured IBM BladeCenter solutions
  - SMDC helps clients in their quest to become more "Green"
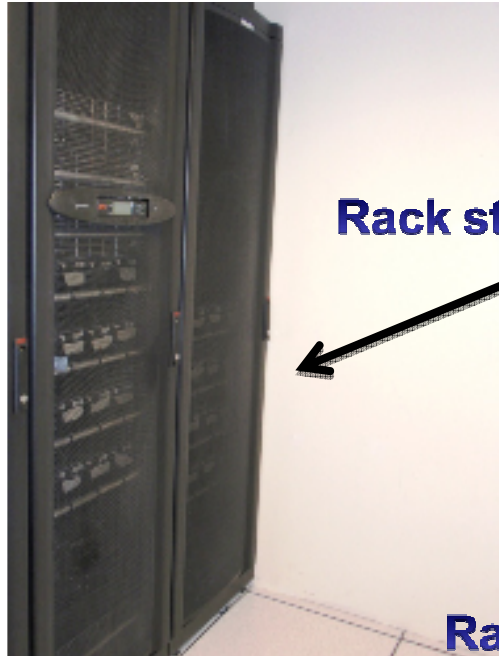
Re-use Racks

Rack starts at WALL
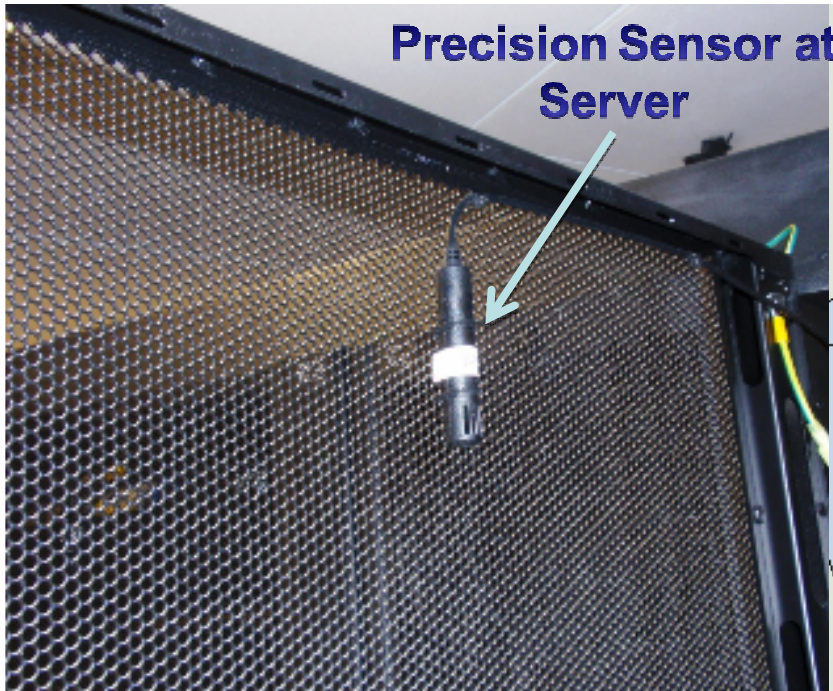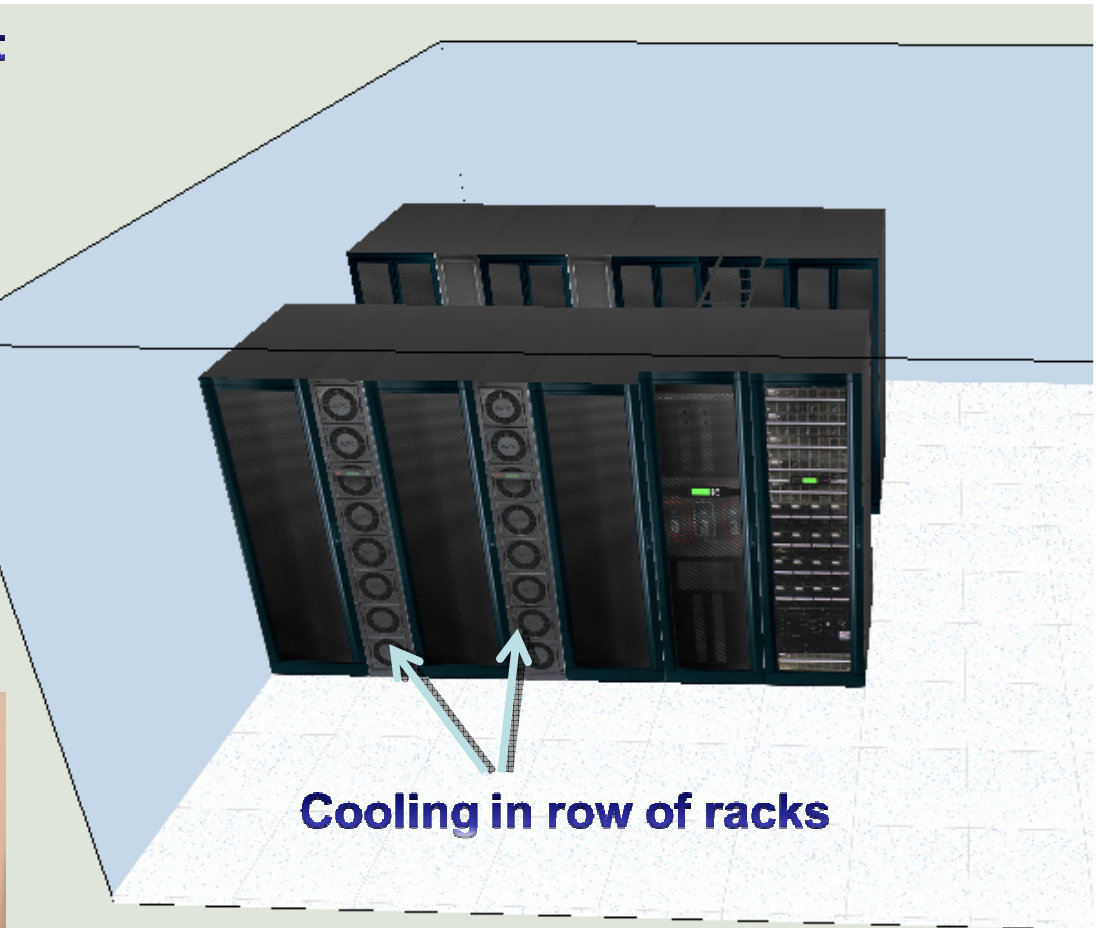
Raised Floor is Optional

Cabling on Top

Precision Sensor at Server

Cooling in row of racks

IG55

RDHx Cooling Architecture
(Rear Door Heat eXchanger)

Rear Door Heat eXchanger

Inlet 27°C

Outlet 27°C

Air flow

Front
Cold

Back
Hot

IBM Enterprise Rack

water lines

Perf tile

Cable Opening

Tile floor

Underfloor Chilled Air

Subfloor
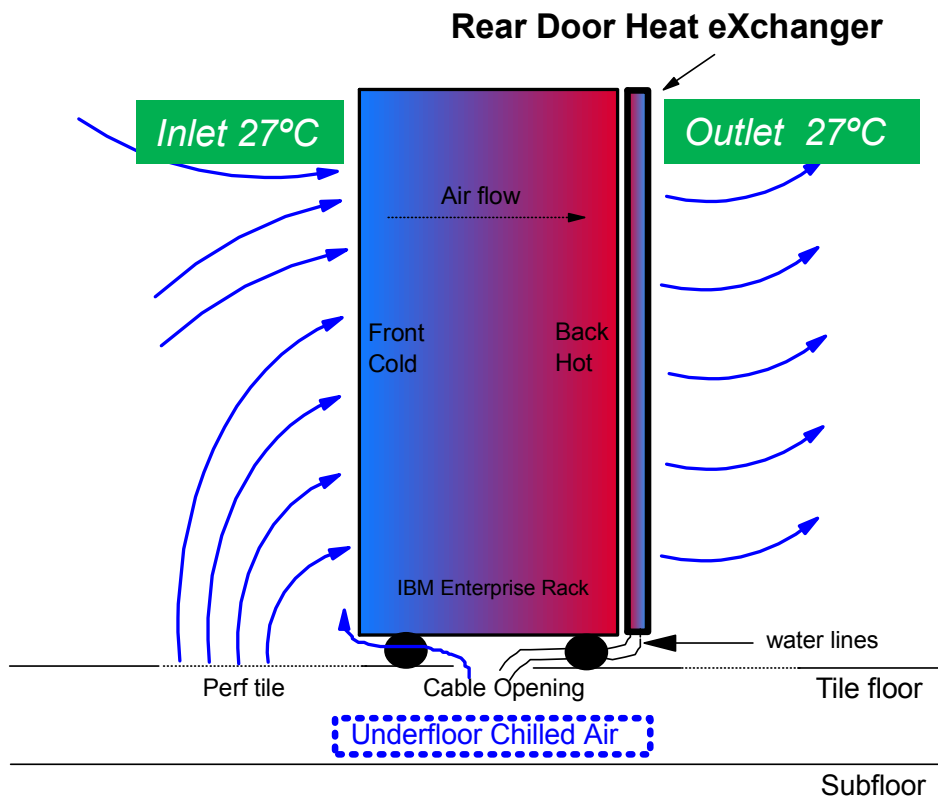
How does it work?

Today, up to 20kW Rack Density with chilled water solution: -
- ➢ *Cold Air enters the front*
- ➢ *Hot Air enters the RDHx*
- ➢ *100% of Heat is transferred via the chilled water circulating in the Secondary Loop serving the RDHx*
- ➢ *Reduces or eliminates the need for other cooling solutions*

Above 20kW Rack Density: -
- ➢ *Heat above 20kW is discharged into the data center to be cooled by other cooling systems*

Removing the heat in specialized racks **BEFORE** the hot air gets into the hot aisle is an energy efficient approach

- Proven performance
  - Engineered by IBM with 30+ years in liquid cooling computers
  - Passive operation
- Increased density
  - Removes up to 60% of heat, or 20kW
  - Allows for high-density deployment
- Energy efficient
  - Lessens burden on CRAC/CRAH units
  - More efficient than fan based systems
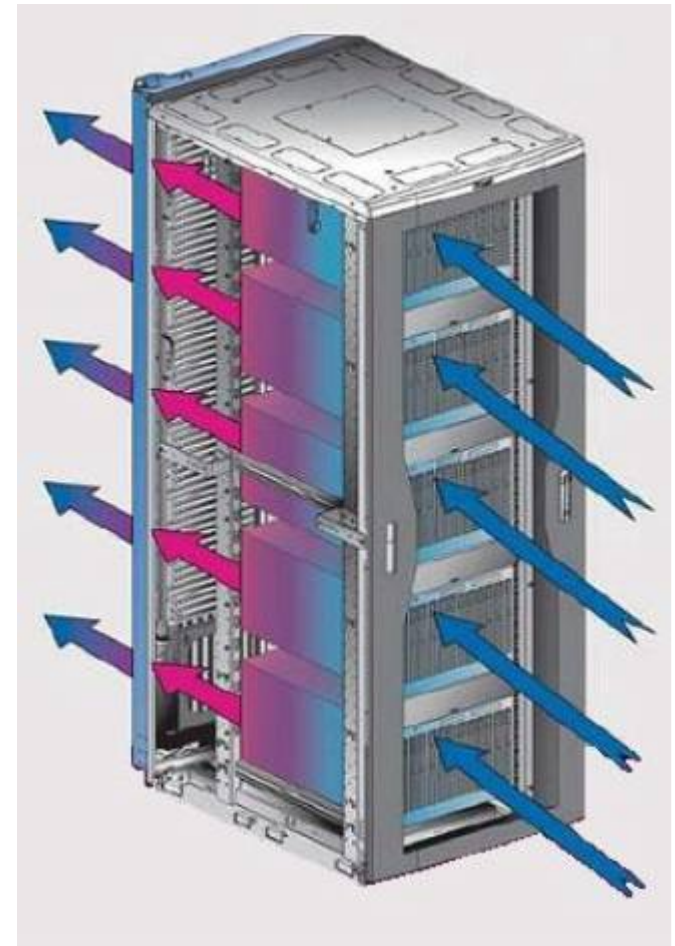
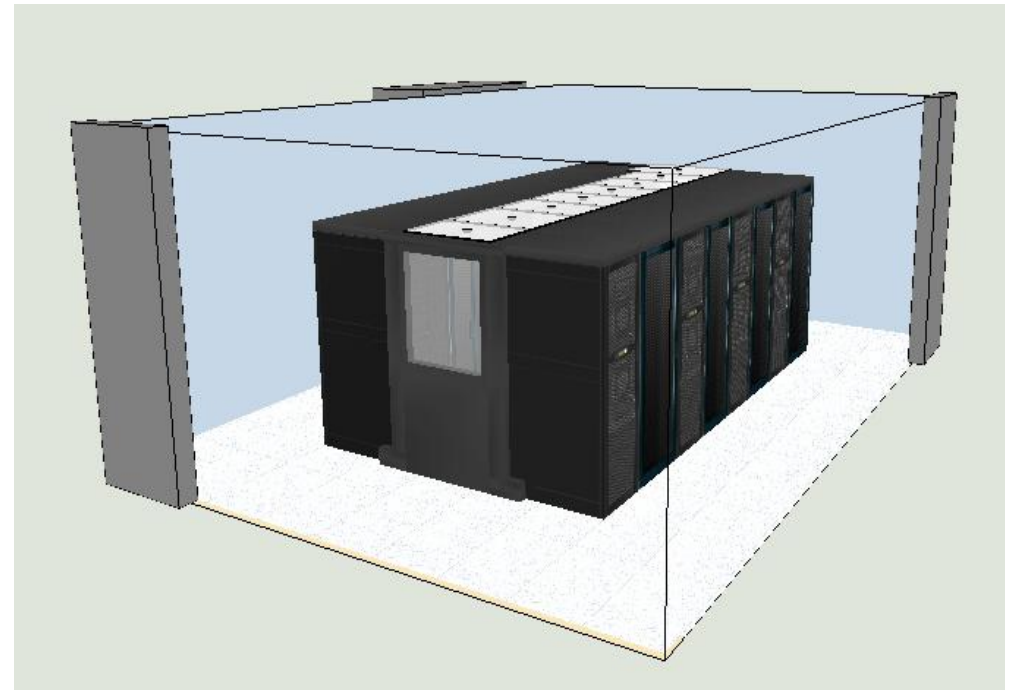A hot aisle containment option can be utilized to prevent hot exhaust air from mixing with the cooled supply air thereby increasing cooling capacity and efficiency

Figure 6– InfraStruXure HD – APC Symmetra UPS, PDU, NetShelter SX Racks, and InRow RC Cooling Units
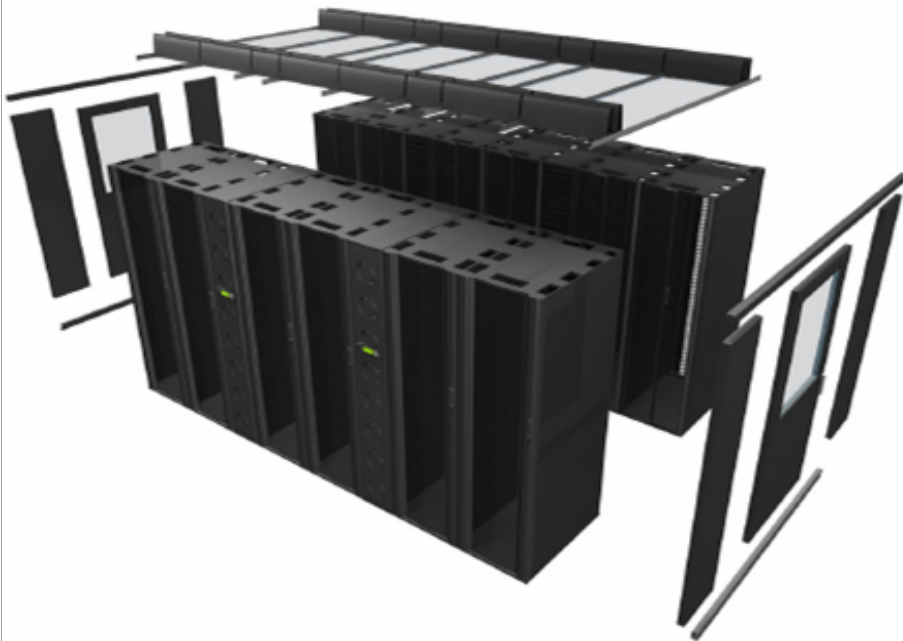
Hot aisle containment options

(Ceiling, door and frame enclosure assemblies)
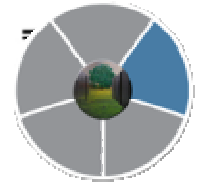
IBM Service Management's Green Data Center

Using green data to accelerate infrastructure value to your business services

Green Business Services

NEW! Tivoli Monitoring For Green Energy

Optimize Assets by Energy Usage

Intelligent Chargeback

Energy Aware Provisioning
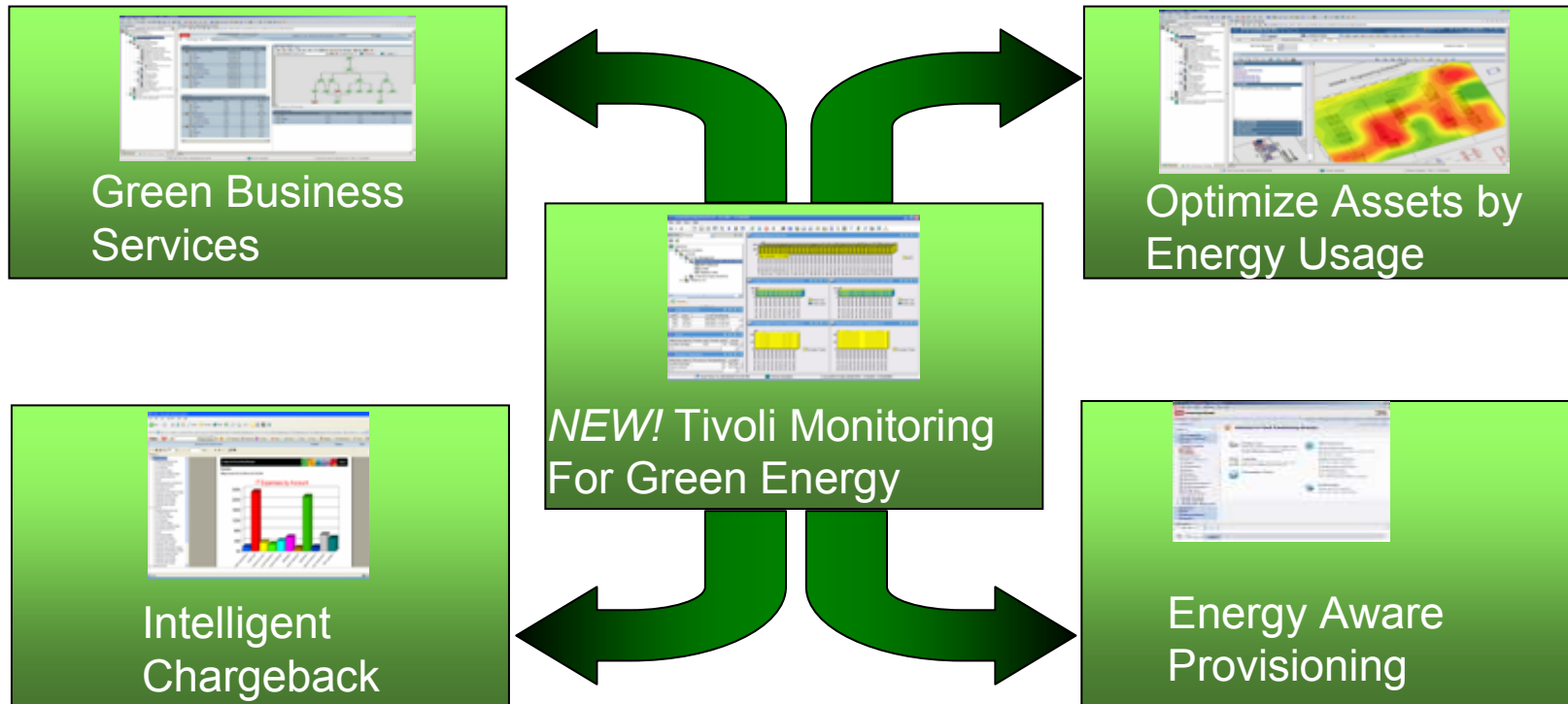
Let's build a smarter planet.

VIRTUALIZATION

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Value of a Virtualized Infrastructure

Increase utilization

> Most practical choice to achieve full consolidation
> Capability to pool resources to service a workload
> Can improve availability and reliability (LPAR, SAN, Clustering)

Improve productivity

> Creates virtualized infrastructure for test and development
> Improves rapid deployment and scaling of workloads
> Use common tools across many systems, simplified resource management

Link infrastructure performance to business goals
Use policy to adjust resources based on requirements of the business

> Analyze application performance based on business policy

> Improve business resilience

Long-Term Focus on Virtualization Across our Systems

System z9™ zSeries® **System p5 ™ pSeries®** **iSeries ™** **xSeries®** **BladeCenter™** **IBM System Storage ™** **OpenPower®**
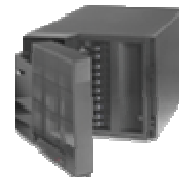
While virtualization sounds complex, it's really a simple idea. IBM Systems can provide virtualization capabilities that are unique in the marketplace.

Evolutionary virtualization

- IBM mainframe virtualization – 40-yr history of world-class hardware and software innovation
- Open development leveraged across all servers and storage systems
- All IBM eServer systems can run multiple operating systems concurrently
- Can help manage non-IBM server and storage infrastructures
- Virtualization features do not require "rip and replace" hardware and software upgrades
- Builds on existing infrastructure to help manage heterogeneous environments

IBM Virtualization Engine™ solution is end-to-end

Virtualization Planning Tools

Virtual Resource Access

Programmatic Interface
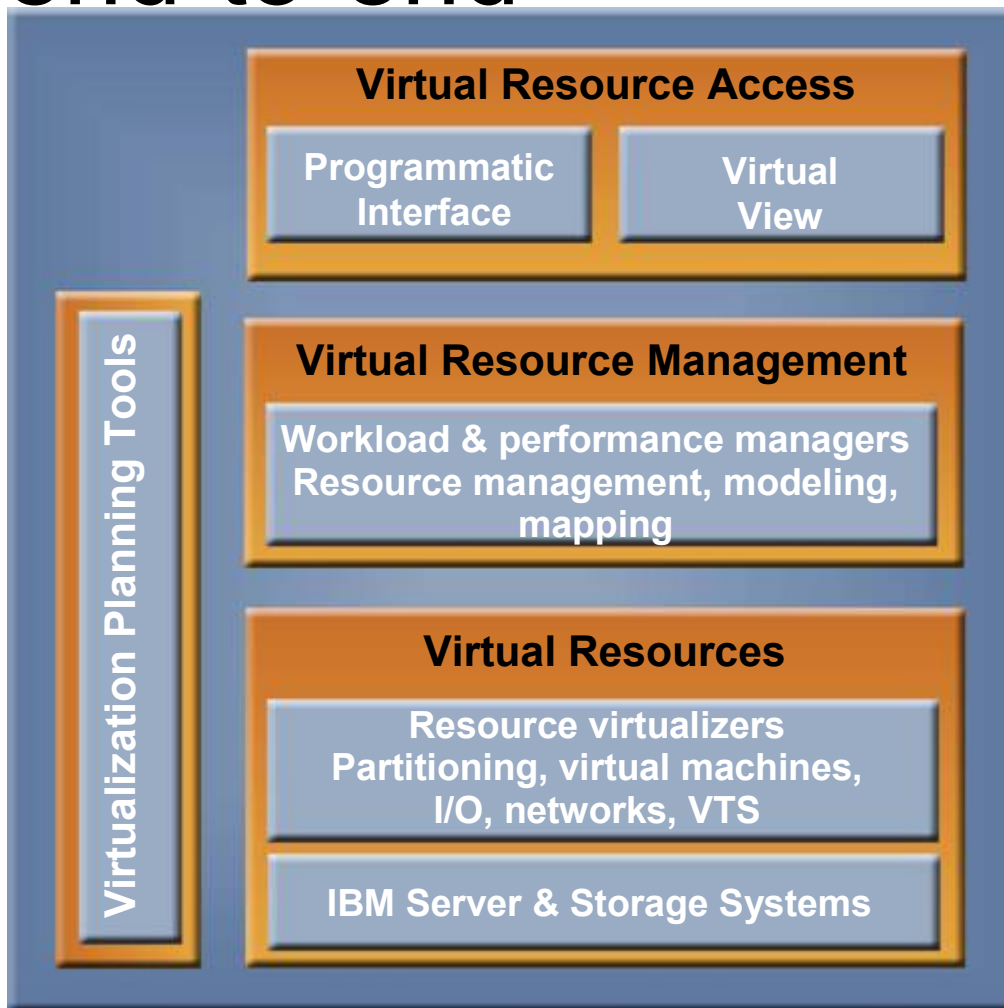
Virtual View

◀ *Virtualized view*

Virtual Resource Management

Workload & performance managers Resource management, modeling, mapping

◀ *Virtualized management*

Virtual Resources

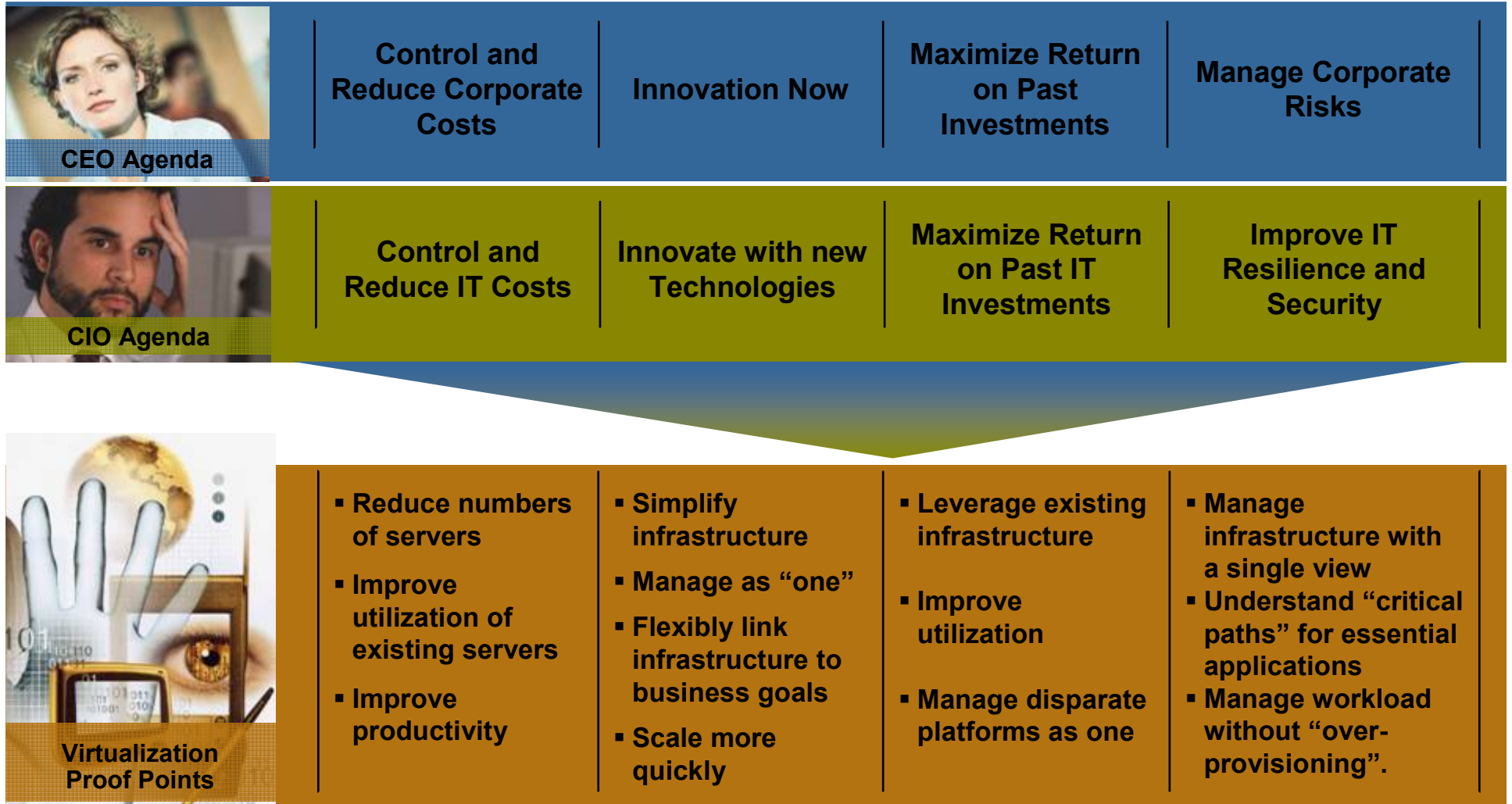Resource virtualizers Partitioning, virtual machines, I/O, networks, VTS

IBM Server & Storage Systems

◀ *Virtualized resources*

IBM Virtualization Engine

How Can Virtualization Help Solve Real Business Problems?

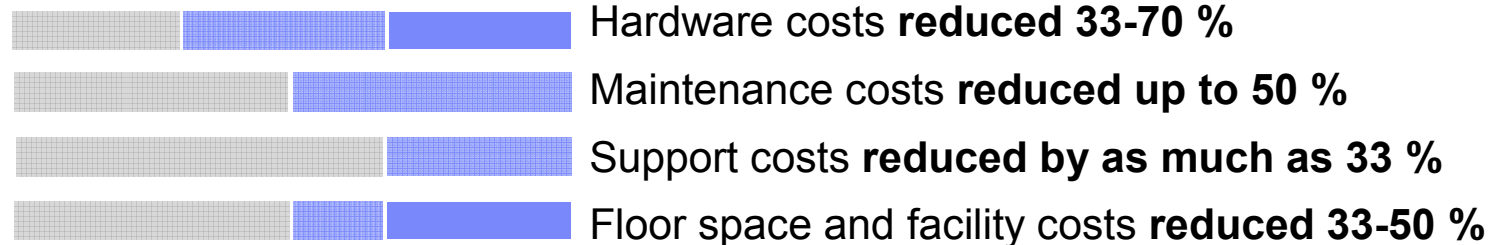| CEO Agenda	Control and Reduce Corporate Costs	Innovation Now	Maximize Return on Past Investments	Manage Corporate Risks
CIO Agenda	Control and Reduce IT Costs	Innovate with new Technologies	Maximize Return on Past IT Investments	Improve IT Resilience and Security
Virtualization Proof Points	• Reduce numbers of servers • Improve utilization of existing servers • Improve productivity	• Simplify infrastructure • Manage as "one" • Flexibly link infrastructure to business goals • Scale more quickly	• Leverage existing infrastructure • Improve utilization • Manage disparate platforms as one	• Manage infrastructure with a single view • Understand "critical paths" for essential applications • Manage workload without "over-provisioning".

GTS Server Consolidation and Virtualization Service
Significant savings from x86 to mainframe implementations

- *Cost savings:* Based on IBM's experience*, the following represents the typical savings that organizations may realize:

  Hardware costs **reduced 33-70 %**

  Maintenance costs **reduced up to 50 %**

  Support costs **reduced by as much as 33 %**

  Floor space and facility costs **reduced 33-50 %**

- *IBM GTS can help clients . . .*

  – Realize ROI in as little as six months

  – Reduce TCO by 30 percent to 70 percent

  – Increase server utilization rates of up to 80 percent—in contrast to the more typical 5 percent to 15 percent

  – Realize consolidation ratios ranging from 8:1 to 30:1

  – Lower power and cooling costs by 10% to 30%

Before Consolidation/Virtualization

- Servers account for 50-75% of the data center's total floor space
- Server sprawl is a challenge, resulting in high maintenance and support costs
- Server utilization only 5-15% on average

After Consolidation/Virtualization

- Servers typically account for only 20-50% of the data center's total floor space
- Consolidation ratios from 6:1 to 20:1
- Typical TCO savings from 30-70%
- Server utilization rates up to 80%

* Results will vary widely based on several factors including # of servers and work load types.

IBM

VMware Server Virtualization Services Help Clients Build a Solid Foundation for Optimized x86 Environments

vmware®

Description:

IBM Server Optimization and Integration Services – VMware server virtualization can help clients build a solid foundation to an x86-processor based environment.

Potential benefits:

- Reduce hardware requirements by a 6:1 ratio or better

- Reduce hardware and operating costs by as much as 50% and time to provision new servers by up to 70%

- Reduce energy costs by 10-40%.

- Save more than $3,000 per year for every server workload virtualized

Source: IBM Analysis, 2008

Enhanced Storage Virtualization

• TS7530 Tape Virtualization

–**New configuration and added functionality to existing and new TS7500 virtualization customers**

–**Curb storage growth in data centers to "go green"**

• SAN Volume Controller 4.3

–**New Space-Efficient Virtual Disk ('thin provisioning') and Space-Efficient FlashCopy ('snapshot') functions**

–**New Virtual Disk Mirroring contribute to making data centers more "green"**

–**IBM has shipped over 12,000 SVC engines running in more than 4,000 SVC systems worldwide**

Energy Efficiency and Storage

▪ *Case studies show that an environment that appropriately blends in the use of tape for archiving and retention can reduce storage energy costs by as much as 10X*

▪ *Deduplication case studies show energy costs reductions, for the required physical storage capacity requirements, reduced by 25x*
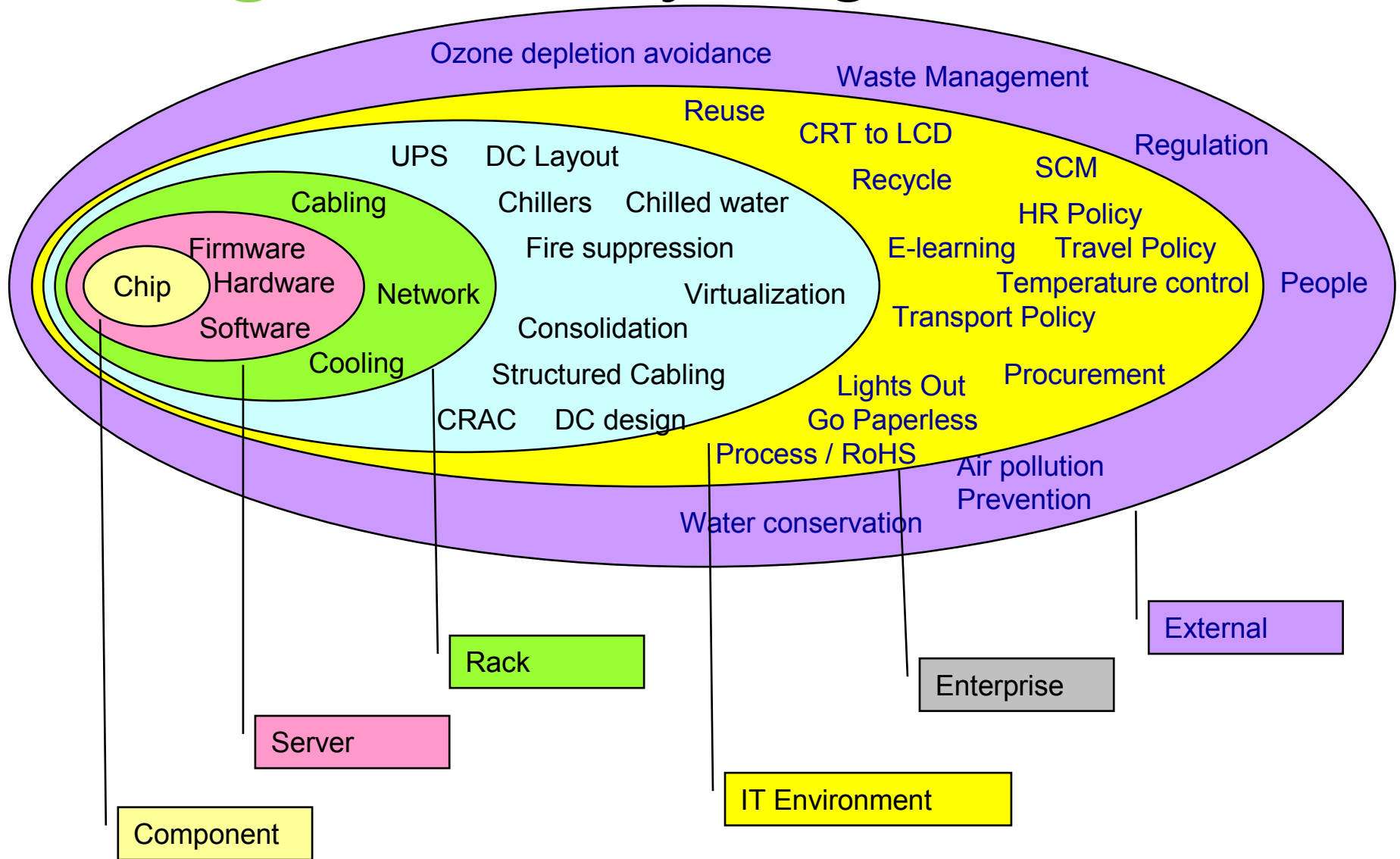
Green Networks

How **green** can you go?
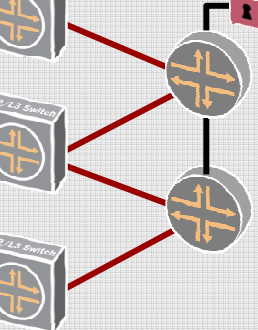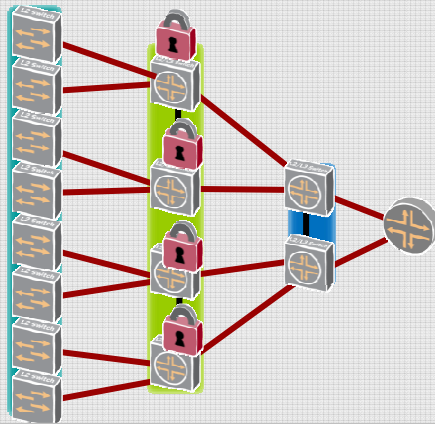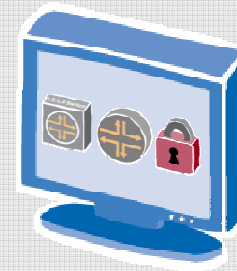
Action Plan for GREEN IT

- ❑ **Define your Virtualization Strategy**

- ❑ **Assess your Data Center efficiency**

- ❑ **Design DC with GREEN in mind**

- ❑ **Identify GREEN collaboration processes**

- ❑ **Determine GREEN matrices**

- ❑ **Start with a Pilot**

IBM Integrated Communications Services portfolio is designed to help clients realize the full potential of integration

Business

Value

Infrastructur

Telecom Expense Management
- Network and communications costs management & control

Network Convergence
- Assess / Diagnostic / ROI
- Consolidation/ Simplification
- Voice data video on IP (InternetProtocol)

Data Center Networks
- High availability and performance
- Virtualization

Campus & LAN
- Technology refresh and deployment

WAN
- Secure, resilient networks globally

Network Infrastructure solutions

IP Telephony
- Enterprise class voice over IP

Digital Community
- Community Internet Access
- Public safety
- First responders

Enterprise Mobility
- Mobile Workers
- Campus Mobility
- Distributed Workforce

Voice and Video Solutions

IPTV Infrastructure
- Triple play capability
- New revenue generating ervices for Telcos

Video Communications
- Telepresence
- Assess, design, implement
- ROI, Integration

Collaboration Solutions

Business applications solutions

RFID Solutions
- supply chain management
- Asset tracking/ tracing
- Work in progress / manufacturing

IP Contact Center
- Customer sales and service
- Distributed agent support

Real time Collaboration
- Audio/Video conferencing
- Lotus Sametime
- Click to Call

Unified Messaging
- Enhanced communications
- Single voice/email and fax mailbox

Integration

Networking Strategy
- etworking and siness goal alignment

Network Infrastructure Optimization
- Optimized cost/performance

Network Applications Optimization
- Performance analysis and response improvement

Network Management Optimization
- Operational streamlining and tools optimization

Color	ICS Services
	Network Strategy and Optimization
	Converged Communications
	Mobility, Wireless & RFID
	Network Integration & Managed Services
	Telecom Expense Management

October 19, 2007

Let's build a smarter planet.

IBM

Thank
You