The Coming Wave

Green IT and Real Estate Convergence

November 9, 2010

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County of Orange, California

Agenda: "Green IT and Real Estate Convergence"

What is Green IT?

- Definition and Taxonomy
- Carbon Emissions and Top "Green" Corporate Purchasers (Electric)
- Green IT Technology Trends and the County of Orange

Macroeconomic views

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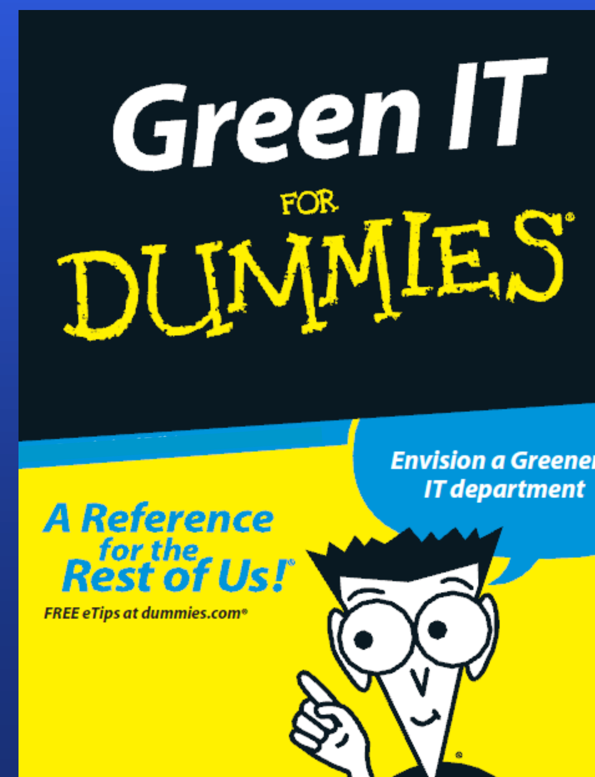
- USGBC LEED and Energy Star
- Clueless CIOs?
- Data Centers: Measures, Opportunities and Roadblocks

Real Estate and IT Convergence

- Building Information Network
- Market Evidence and Example

Questions & Answers



The Coming Wave

What is Green IT?

Green It: Definition

Green computing

From Wikipedia, the free encyclopedia
(Redirected from Green IT)

Green computing is the study and practice of using computing resources efficiently. The primary objective of such a program is to account for the triple bottom line, an expanded spectrum of values and criteria for measuring organizational (and societal) success. The goals are similar to green chemistry; reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste.

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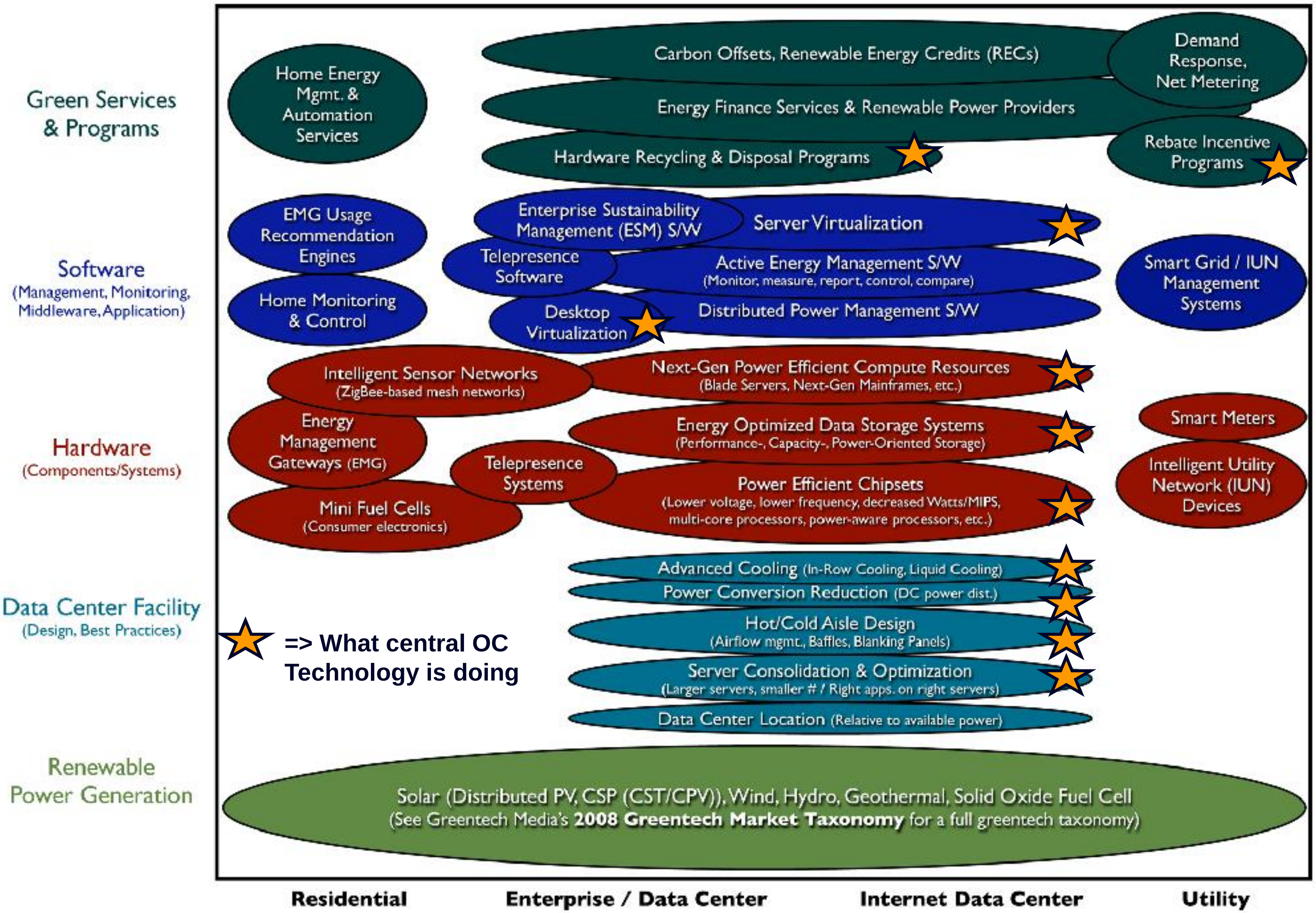
People
Planet
Profit

Source: Wikipedia

greentechmedia

Green IT Taxonomy



Source: GreenTechMedia

Carbon Emissions – Information Technology

Information and communication technologies

IT / I&O Green IT: An Infrastructure and Operations Key Initiative, Gartner, 2008

Carbon Emissions – Information Technology

Definitions:

Transformation *of* IT – direct, first-order impacts related to the manufacture, use and disposition of physical ICT assets and ICT related services, e.g., more energy efficient servers and PCs. The ***"2%"***

Transformation *by* IT - second order impacts with ICT's enabling role, e.g., videoconferencing and collaboration (impact on travel). The ***"98%"***

Rank	All-around Performance	Transformation by IT	Transformation of IT	Internal Environmental Performance	Supply Chain
1	IBM	British Telecom	Fujitsu	Fujitsu	HP
2	Fujitsu	IBM	HP	British Telecom	IBM
3	HP	Cisco	IBM	IBM	British Telecom
4	Cisco Systems	Ericsson	Cisco Systems	HP	Cisco Systems
5	British Telecom	SAP	Alcatel-Lucent	Ericsson	Ericsson
6	Ericsson	HP	Ericsson	Dell	Fujitsu
7	Alcatel-Lucent	Fujitsu	Sun Microsystems	Cisco	Sun Microsystems
8	SAP	Alcatel-Lucent	Xerox	Alcatel-Lucent	Alcatel-Lucent
9	Dell	Accenture	Dell	Xerox	Lenovo
10	Xerox	Wipro	British Telecom	Wipro	Deutsche Telekom
11	Sun Microsystems	Microsoft	Microsoft	Deutsche Telekom	Microsoft
12	Deutsche Telekom	Deutsche Telekom	Deutsche Telekom	Sun Microsystems	Dell
13	Microsoft	Xerox	SAP	TCS	Xerox
14	Wipro	Dell	CSC	SAP	Wipro
15	Accenture	Verizon	Wipro	Lenovo	Verizon
16	CSC	CSC	Lenovo	Microsoft	
17	Lenovo	Sun Microsystems	Accenture	CSC	
18	TCS	TCS	Verizon	Accenture	
19	Verizon	Lenovo	TCS	Verizon	

Source: "Summary Report: Low Carbon and Environmental Leadership in the ICT Industry by Gartner and WWF", Gartner, October 22, 2010

Corporate Purchases of "Green" Electricity

Annual Green Power Usage (kWh)	GP % of Total Electricity Use*	Organization Type	Providers (listed in descending order by kWh supplied to Partner)	Green Power Resources
1. Intel Corporation				
1,433,200,000	51%	Information Technology	Sterling Planet°, On-site Generation, PNM	Biogas, Biomass, Geothermal, Small-hydro, Solar, Wind
2. Kohl's Department Stores				
1,367,376,000	100%	Retail	3Degrees°, WM Renewable Energy°, On-site Generation, Sacramento Municipal Utility District°, City of Dover	Biogas, Biomass, Small-hydro, Solar, Wind
3. Whole Foods Market				
817,657,623	100%	Retail	3Degrees°, Austin Energy, On-site Generation	Solar, Wind
4. Starbucks				
573,432,000	55%	Restaurants & Food Srvcs.	Nexant°, 3Degrees°	Wind
5. Commonwealth of Pennsylvania				
500,000,000	50%	Govt. (State)	Renewable Choice Energy°	Various
6. City of Houston, TX				
438,000,000	34%	Govt. (Local, Municipal)	Reliant Energy	Wind
7. Dell Inc.				
431,058,000	129%	Information Technology	NextEra Energy Resources°, TXU Energy°, Austin Energy, Oklahoma Gas & Electric, Idaho Power°, On-site Generation	Biogas, Solar, Wind
8. Johnson & Johnson				
416,510,688	39%	Health Care	3Degrees°, NextEra Energy Resources°, GDF Suez Energy Resources NA°, Sempra Energy°, Liberty Power°, On-site Generation, PNM	Biomass, Solar, Wind
9. U.S. Air Force				
339,660,392	4%	Govt. (Federal)	TransAlta Energy Marketing, Sterling Planet°, On-site Generation, Oklahoma Gas & Electric, Colorado Springs Utilities, Rocky Mountain Power°, Champion Energy Services, Georgia Power°, Nexant, Xcel Energy°, PowerSouth Energy	Biogas, Biomass, Solar, Wind

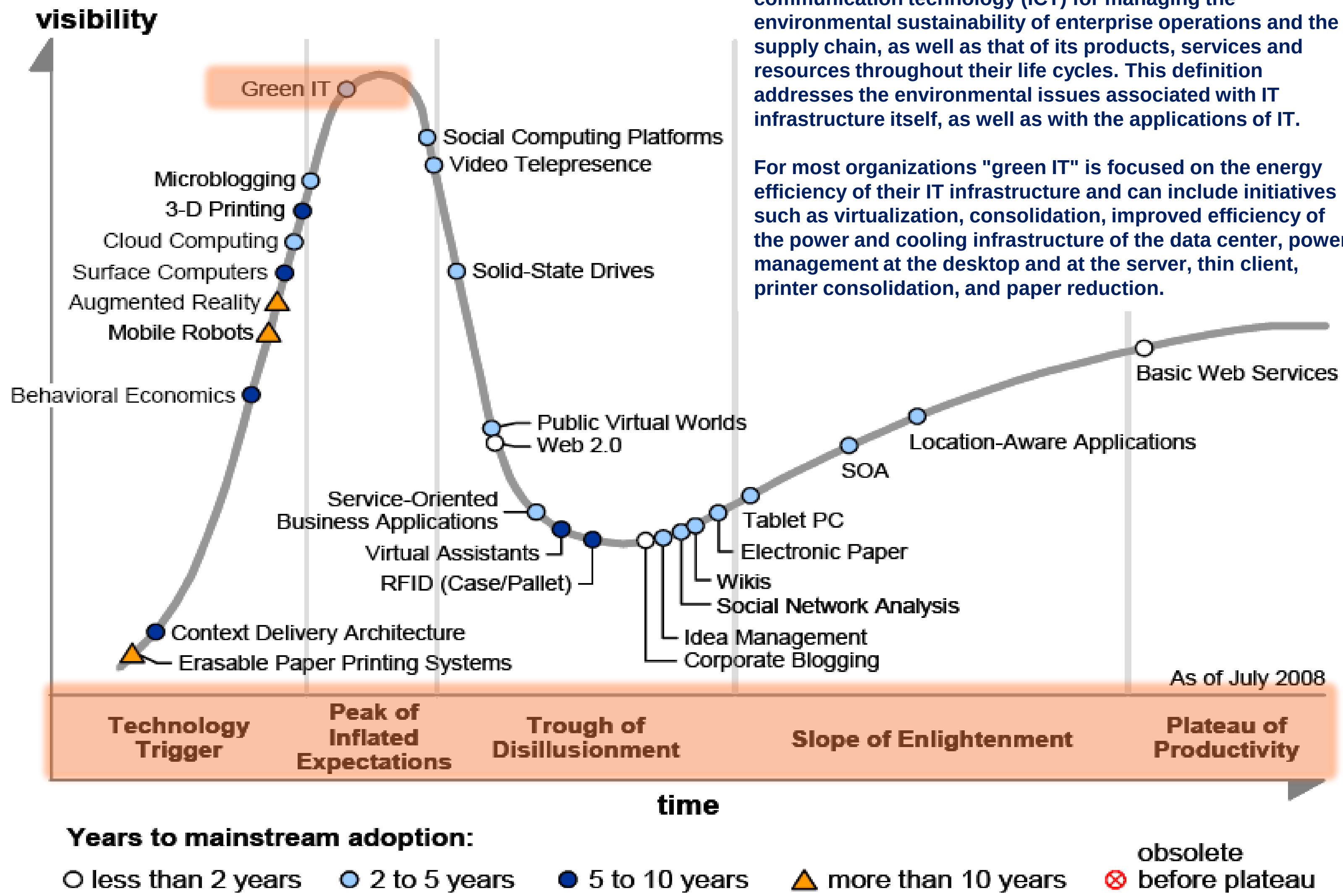
Cooperative, Hess Energy Marketing°, Minnkota Power Cooperative, Western Farmers Electric Cooperative, El Paso Electric, Rocky Mountain Generation Cooperative

Annual Green Power Usage (kWh)	GP % of Total Electricity Use*	Organization Type	Providers (listed in descending order by kWh supplied to Partner)	Green Power Resources
10. City of Dallas, TX				
333,659,840	40%	Govt. (Local, Municipal)	GDF Suez Energy Resources NA	Wind
11. HSBC North America				
300,000,000	112%	Banking & Fin. Srvcs.	NextEra Energy Resources°	Wind
12. Cisco Systems, Inc.				
270,209,528	29%	Information Technology	Sterling Planet°, Austin Energy, AmerenUE°	Biomass, Wind
13. Wal-Mart Stores, Inc. / California and Texas Facilities				
263,533,433	8%	Retail	Duke Energy, On-site Generation	Biogas, Solar, Wind
14. U.S. Environmental Protection Agency				
262,100,000	100%	Govt. (Federal)	3Degrees°, NextEra Energy Resources, Bonneville Environmental Foundation°, Pacific Power°, On-site Generation, Minnesota Power	Biogas, Biomass, Solar, Wind
15. District of Columbia				
244,267,000	50%	Govt. (Local, Municipal)	Washington Gas Energy Services°	Wind
16. TD Bank, N.A.				
240,333,272	100%	Banking & Fin. Srvcs.	Community Energy°, Renewable Choice Energy°	Wind
17. BNY Mellon				
229,500,000	77%	Banking & Fin. Srvcs.	NextEra Energy Resources°, Pepco Energy Services°	Wind
18. City of Chicago, IL				
215,000,000	20%	Govt. (Local, Municipal)	Renewable Choice Energy°	Wind
19. University of Pennsylvania				
201,841,600	48%	Education (Higher)	Community Energy°, On-site Generation	Solar, Wind
20. BD				
200,631,536	38%	Health Care	NextEra Energy Resources°, Rocky Mountain Power°	Wind
339,660,392	4%	Govt. (Federal)	Generation, Oklahoma Gas & Electric, Colorado Springs Utilities, Rocky Mountain Power°, Champion Energy Services, Georgia Power°, Nexant, Xcel Energy°, PowerSouth Energy	Biogas, Biomass, Solar, Wind

Source: National Top 50 Partner List (as of October 5, 2010), EPA

Technology Trends

Figure 1. Hype Cycle for Emerging Technologies, 2008

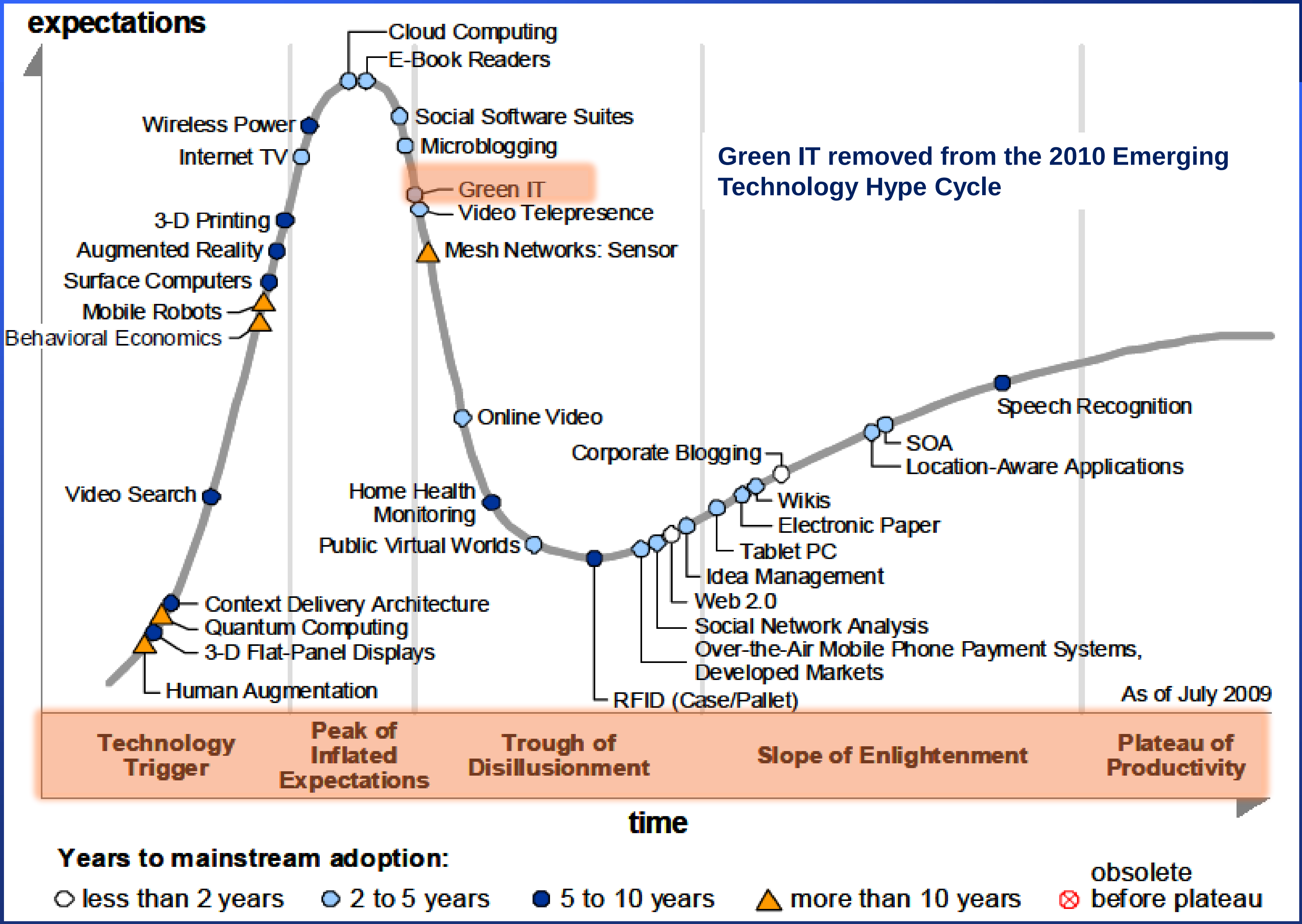


Green IT involves the optimal use of information and communication technology (ICT) for managing the environmental sustainability of enterprise operations and the supply chain, as well as that of its products, services and resources throughout their life cycles. This definition addresses the environmental issues associated with IT infrastructure itself, as well as with the applications of IT.

For most organizations "green IT" is focused on the energy efficiency of their IT infrastructure and can include initiatives such as virtualization, consolidation, improved efficiency of the power and cooling infrastructure of the data center, power management at the desktop and at the server, thin client, printer consolidation, and paper reduction.

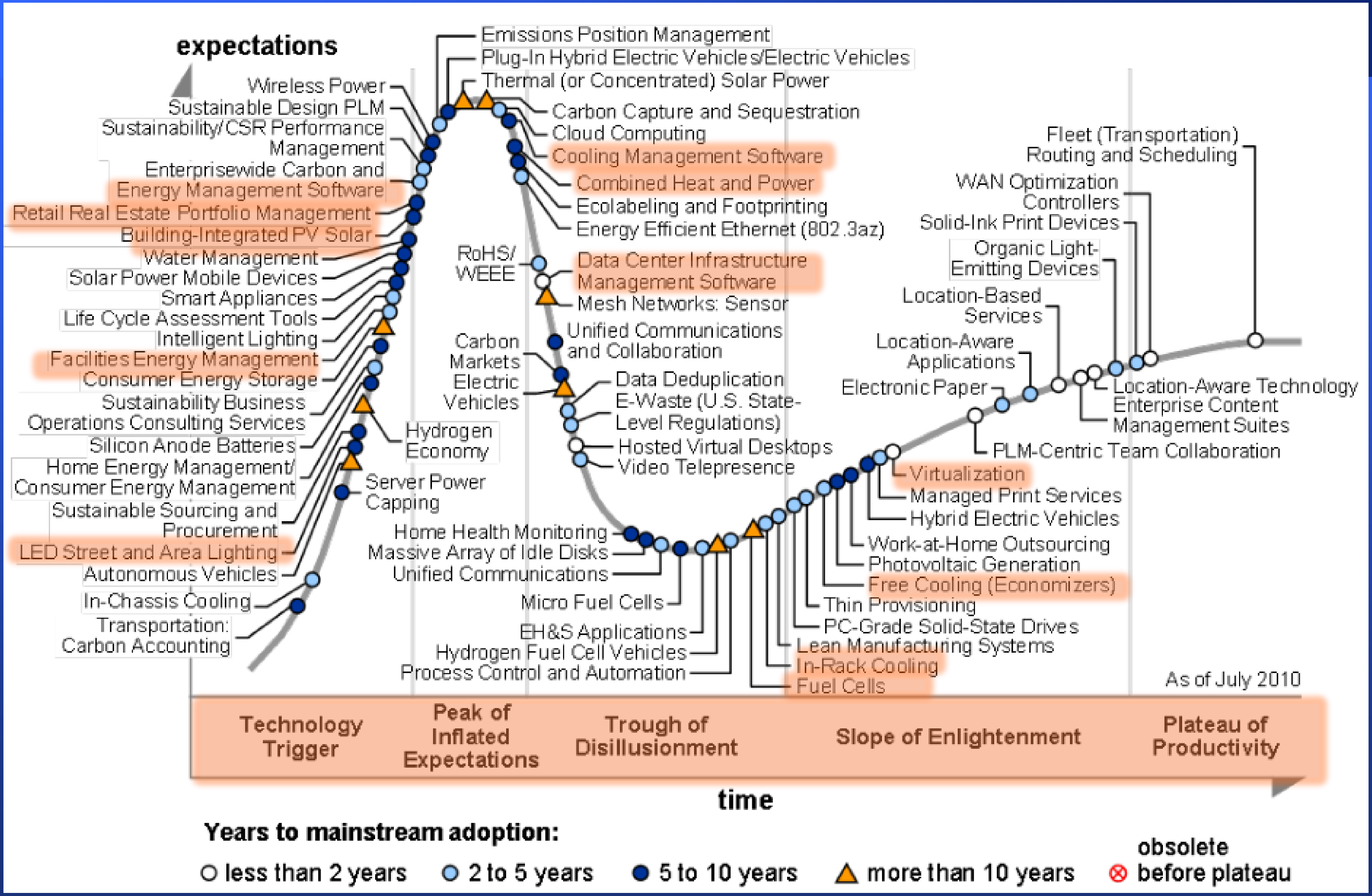
Source: Hype Cycle for Emerging Technologies, 2008, Gartner, July 9. 2008

Technology Trends



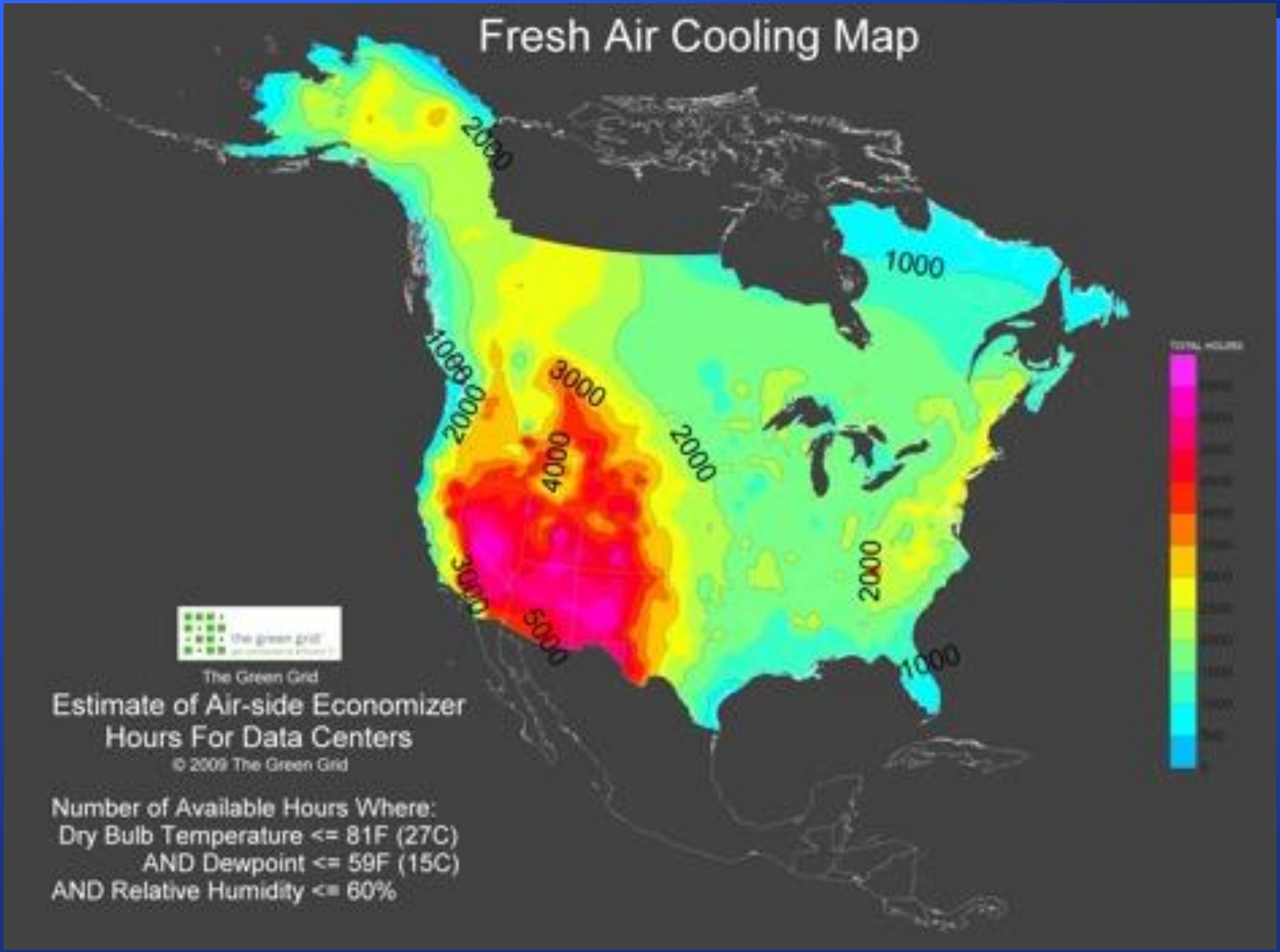
Source: Hype Cycle for Emerging Technologies, 2009, Gartner, July 21. 2009

Technology Trends

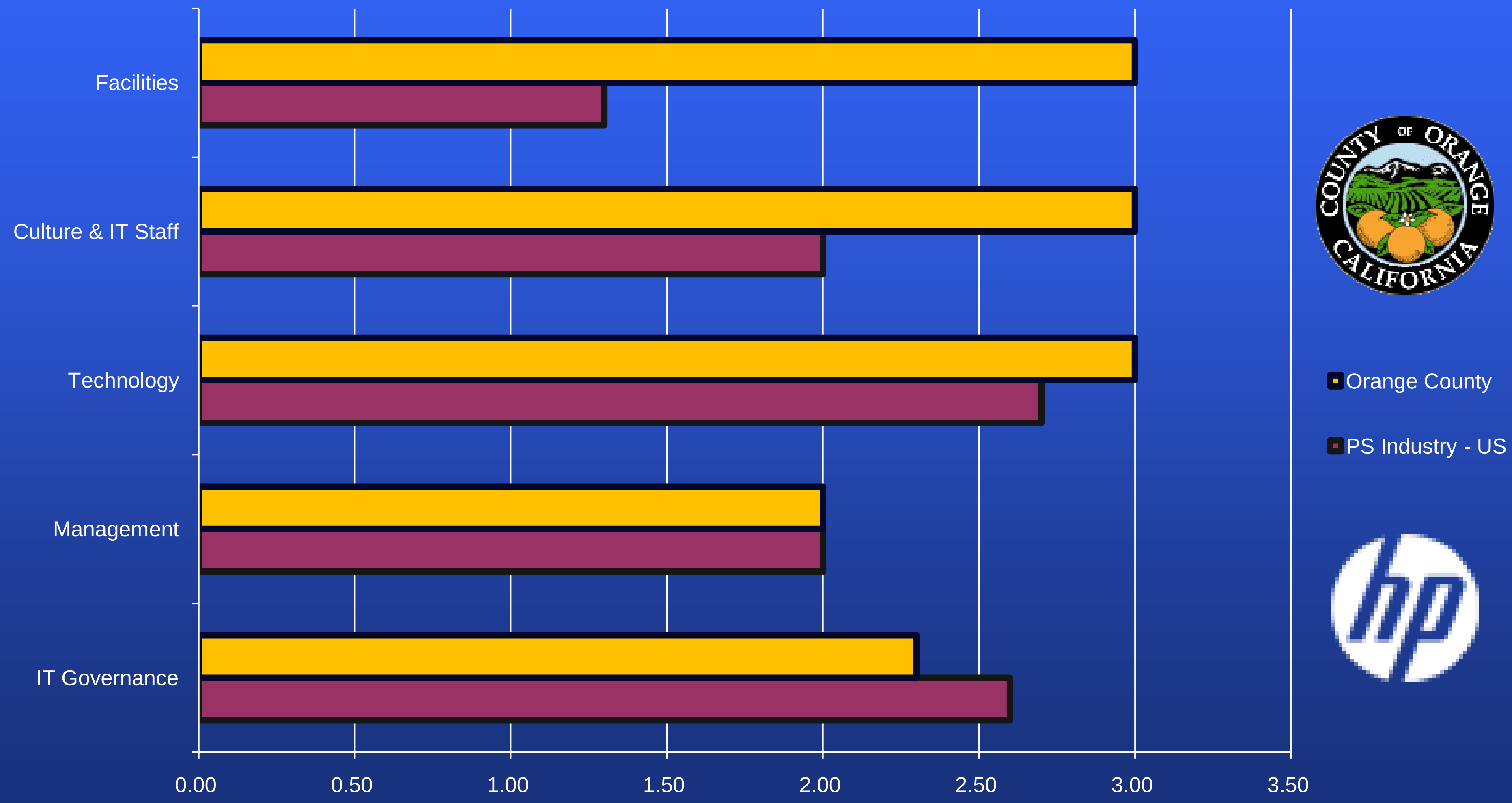


Source: Hype Cycle for Sustainability and Green IT, Gartner, July 29. 2010

Economizer Hours for a Data Center



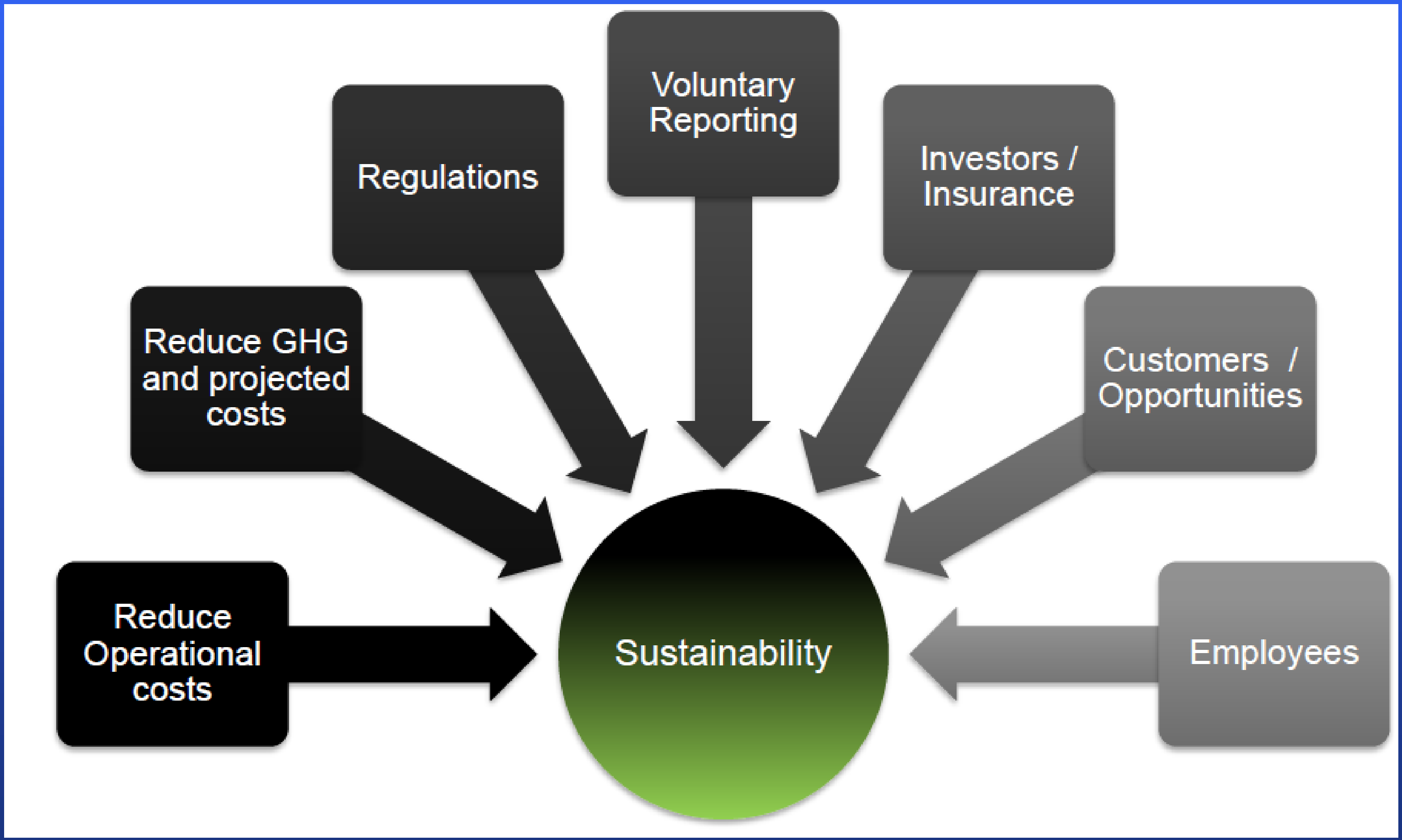
Orange County Data Center: Green IT Assessment



Source: Hewlett Packard's Converged Infrastructure Maturity Model, Orange County Data Center, July 2010

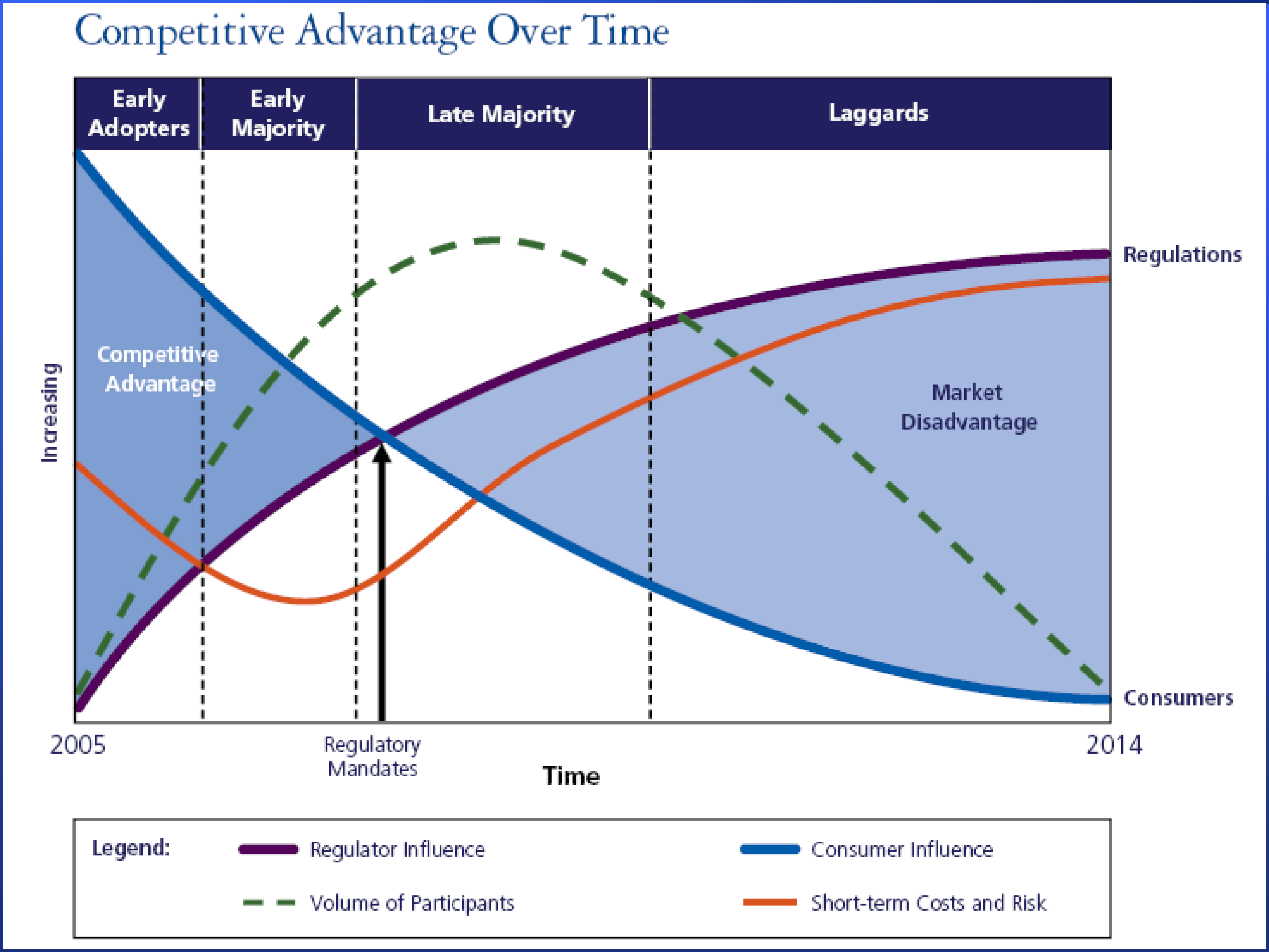
Macroeconomic Views

Drivers for Sustainability



Source: "Sustainability Services Introduction", Hitachi Consulting, August 2010

Drivers: Regulations versus Consumer Advantage



Source: “Green IT”, Deloitte Consulting

Energy Star

Energy Star is an international standard for energy efficient consumer products. It was first created as a United States government program in 1992, but Australia, Canada, Japan, New Zealand, Taiwan and the European Union have also adopted the program. Devices carrying the Energy Star logo, such as computer products and peripherals, kitchen appliances, buildings and other products, save 20%-30% on average.[1] However, many European-targeted products are labeled using a different standard, TCO Certification, a combined energy usage and ergonomics rating from the Swedish Confederation of Professional Employees (TCO) instead of Energy Star.

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3.3 Other Facilities
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Next Big Thing?

Lighting [edit]

The ENERGY STAR is awarded to only certain bulbs that meet strict efficiency, quality, and lifetime criteria.

ENERGY STAR qualified fluorescent lighting uses 75% less energy and lasts up to ten times longer than normal incandescent lights.

ENERGY STAR Qualified Light Emitting Diode (LED) Lighting:

- Reduces energy costs — uses at least 75% less energy than incandescent lighting, saving on operating expenses.
- Reduces maintenance costs — lasts 35 to 50 times longer than incandescent lighting and about 2 to 5 times longer than fluorescent lighting. No bulb-replacements, no ladders, no ongoing disposal program.
- Reduces cooling costs — LEDs produce very little heat.
- Is guaranteed — comes with a minimum three-year warranty — far beyond the industry standard.
- Offers convenient features — available with dimming on some indoor models and automatic daylight shut-off and motion sensors on some outdoor models.
- Is durable — won't break like a bulb.

Energy Efficiency – Opportunity Analysis

SMART 2020 US Addendum: **Four main ICT Opportunities**:

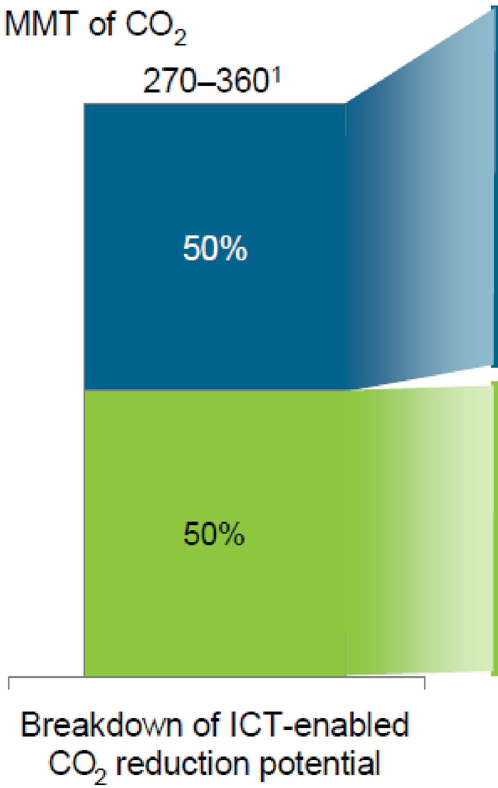
	Savings by 2020 MMT of CO_2	Dollars - Billions -
1. Smart Grid	230 – 480	$15 – 35
2. Road Transportation	240 – 440	65 – 115
3. Smart Buildings	270 – 360	40 – 50
4. Travel Substitution	70 – 130	20 – 40

Notes:
1. Baseline in US is 5,980 MMT (2007)
2. Savings are computed at $0.09 / kWh

Source: "Smart 2020: Enabling the low carbon economy in the information age, United States Addendum", Boston Consulting Group, 2008

Energy Efficiency – Opportunity Analysis

U.S. reduction potential in 2020

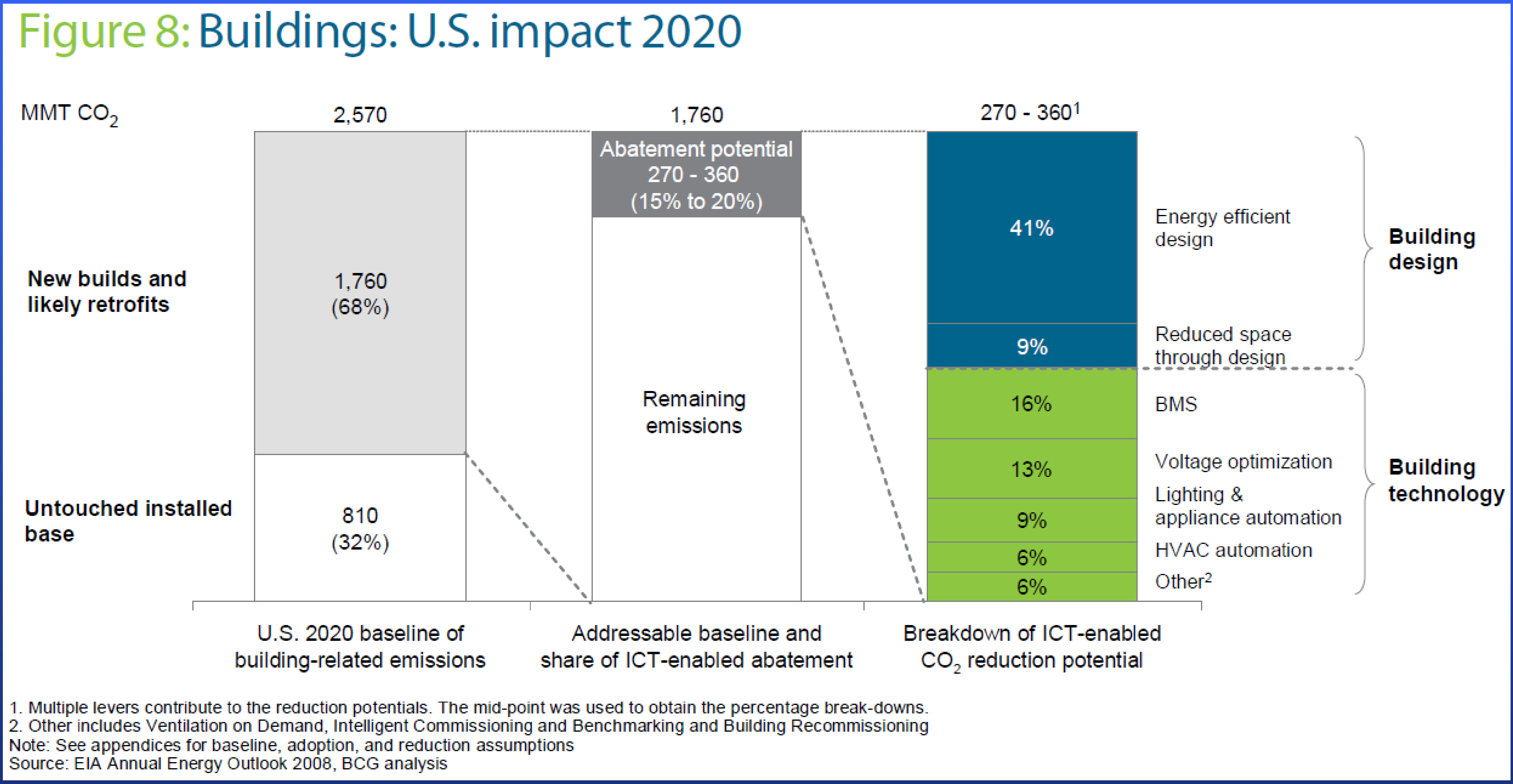


	Description	Example
Smart Building design	• Design buildings that have minimal, or even negative, energy consumption	• Simulation and modeling design software: building size, lighting, choice of material, air flows and HVAC sizing • Building Information Modeling (BIM)
Smart Building technology	• Optimize energy consumption of an entire building in real-time based on inputs from occupants, local utilities and outdoor weather	• Smart appliances • Smart sensors and controls • Building Management Systems (BMS) • Smart meters • Decision-making software

1. Multiple levers contribute to the reduction potentials. The mid-point was used to obtain the percentage break-downs. See appendix for details.

Source: "Smart 2020: Enabling the low carbon economy in the information age, United States Addendum", Boston Consulting Group, 2008

Energy Efficiency – Opportunity Analysis



Source: "Smart 2020: Enabling the low carbon economy in the information age, United States Addendum", Boston Consulting Group, 2008

Energy Efficiency – Opportunity Analysis

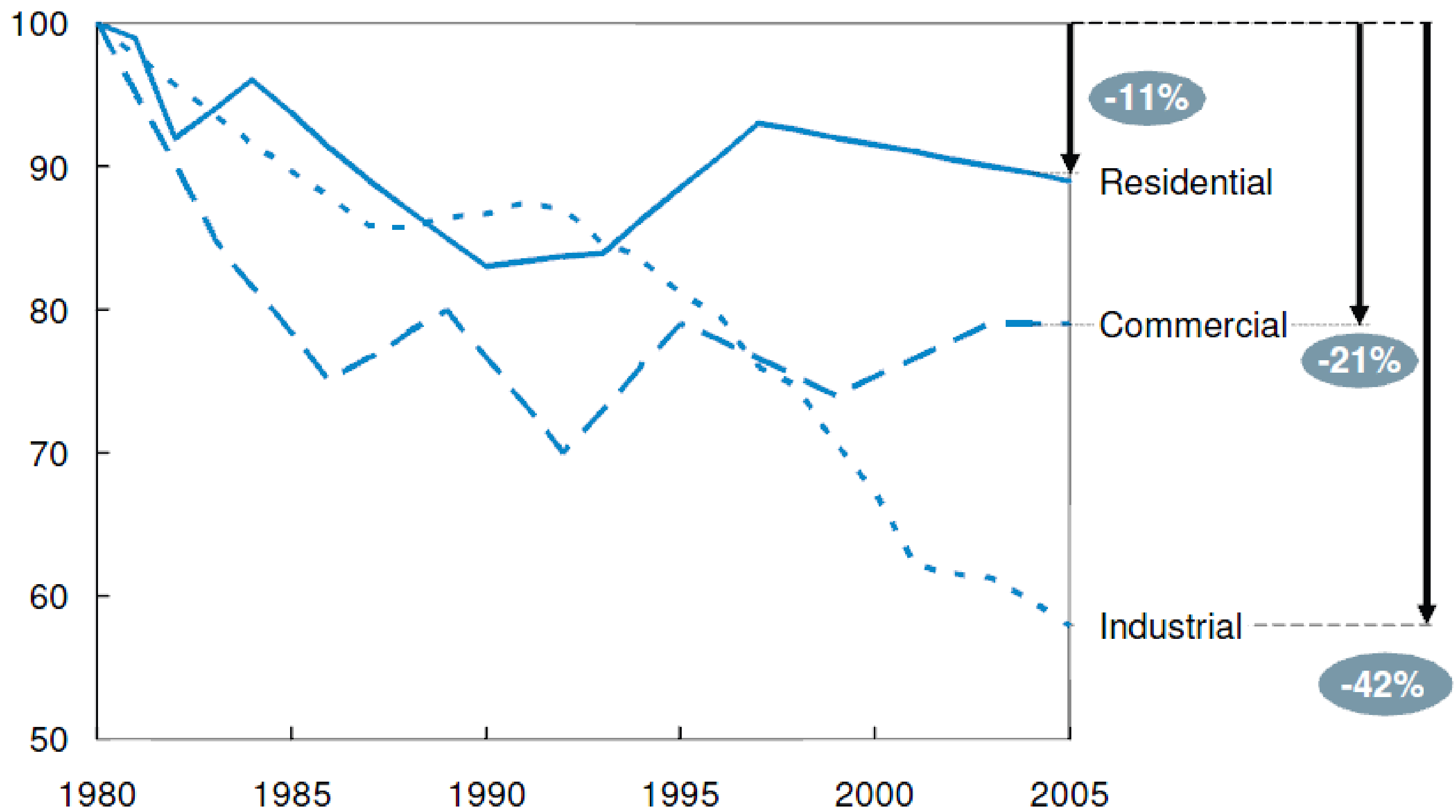
What stands in the way

	Challenges
Technical	• Limited interoperability • Limited deployment of Smart Grid infrastructure
Economic	• Misaligned incentives • High up-front cost
Behavioral	• Shortage of expertise

Source: "Smart 2020: Enabling the low carbon economy in the information age, United States Addendum", Boston Consulting Group, 2008

Energy Efficiency - History

Normalized and indexed, 1980 = 100%*



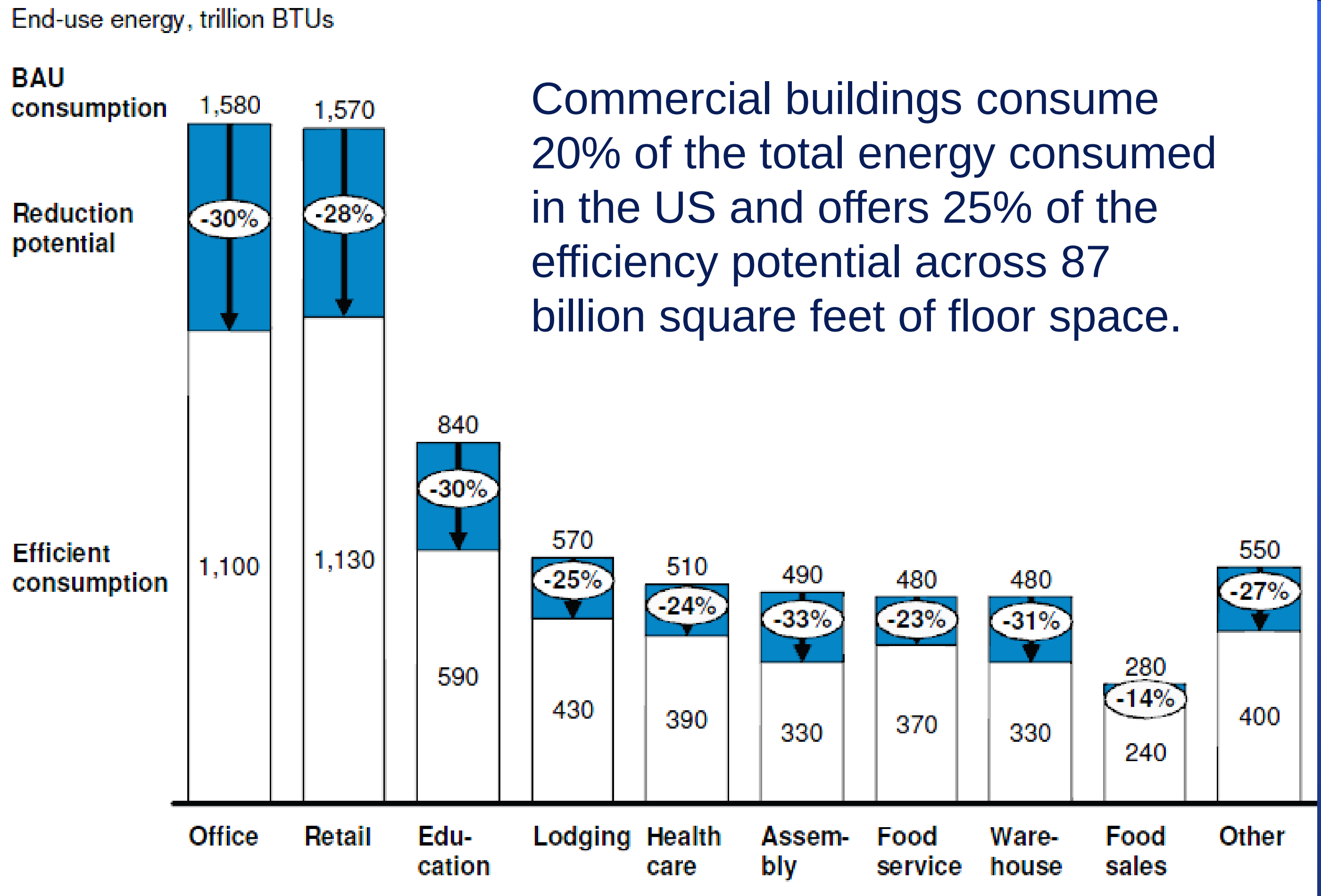
* Residential and commercial indexing is based on BTUs per square foot; industrial indexing is based on BTUs per real dollar of GDP output

Source: "Unlocking Energy Efficiency in the US Economy", McKinsey & Company, July 2009

Potential Energy Reductions

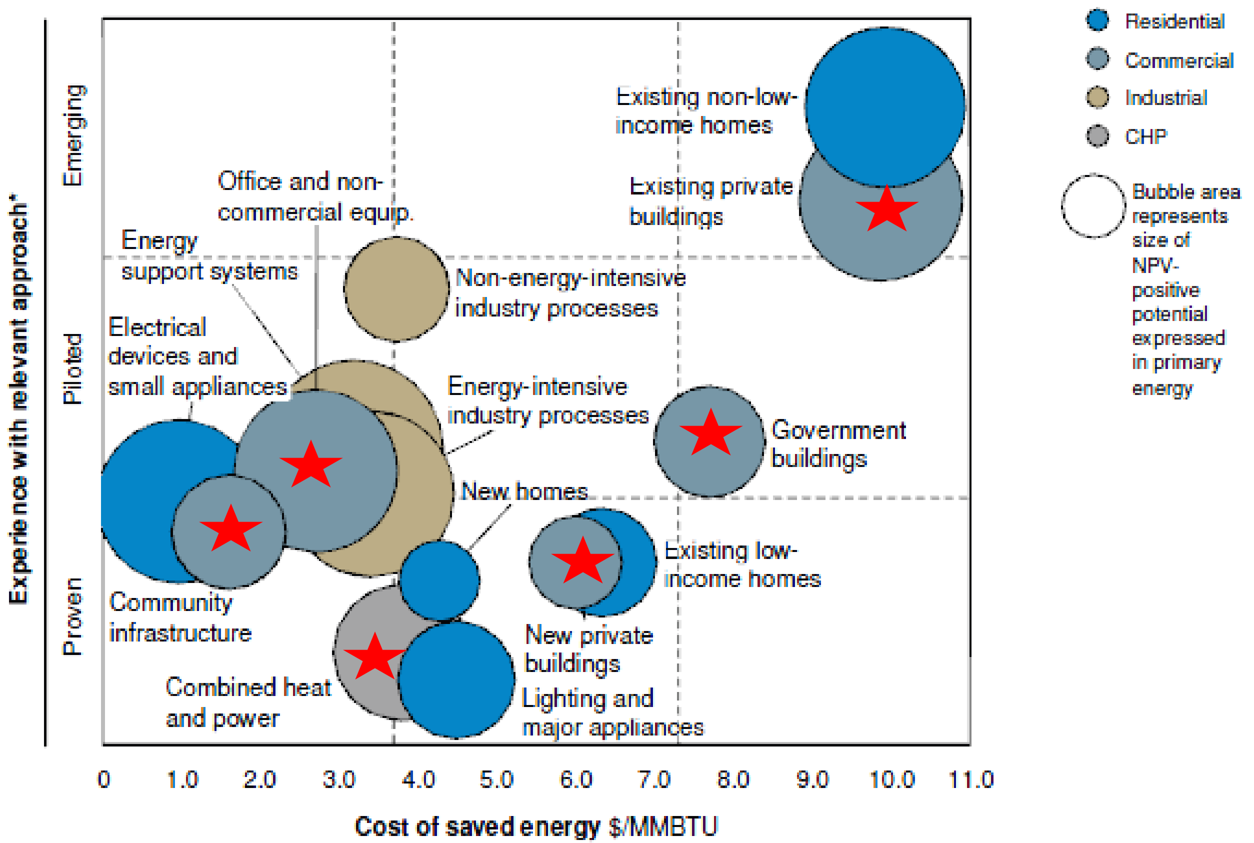
The exhibit displays energy consumption in 2020 associated with various building types in the commercial sector with and without energy efficiency measures implemented.

BAU = Business as Usual



Source: "Unlocking Energy Efficiency in the US Economy", McKinsey & Company, July 2009

NPV Potential – Market Segments



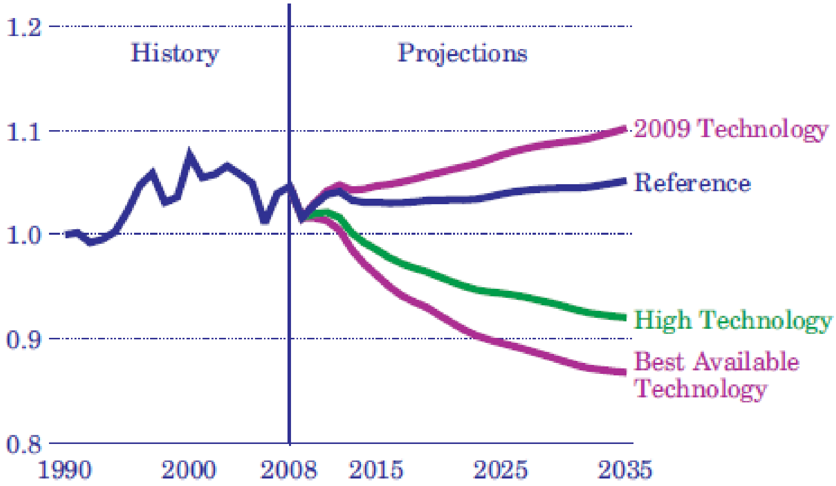
The bubbles depict the NPV-positive efficiency potential in each cluster, measured in primary energy, with the area of the circle proportional to the potential. The position of the bubble's center on the horizontal axis indicates the cost of capturing this potential with the measures modeled in this report (excluding program costs) in dollars per million BTUs per year. The center's position on the vertical axis represents the weighted average of the national experience with the approaches outlined for the cluster.

Source: "Unlocking Energy Efficiency in the US Economy", McKinsey & Company, July 2009

Energy Efficiency – Consulting Analysis

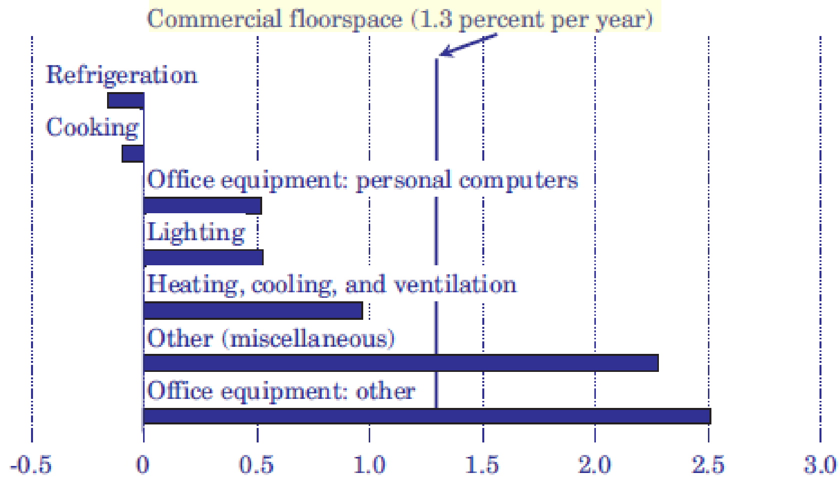
Efficiency improvements could lower projected consumption growth

Figure 46. Commercial delivered energy consumption per capita in four cases, 1990-2035 (index, 1990 = 1)



Electricity leads expected growth in commercial energy use

Figure 47. Average annual growth rates for selected electricity end uses in the commercial sector, 2008-2035 (percent per year)



Notes:
1. Reference case is 4.8% lower than 2009
2. High Technology case is 12.5% lower than Reference case
3. Best Available Technology case is 17.5 % lower than Reference case
4. Office Equipment growth is less than ½ floor space (EnergyStar)
5. Other Office Equipment includes servers and mainframe
6. Other Miscellaneous includes video displays and medical devices

Source: “Annual Energy Outlook, US Energy Information Administration, April 2010

Energy Efficiency – Consulting Analysis

Global SMART 2020

Smart opportunity	Sub-opportunity	2020 U.S. Baseline[1]	Reduction potential[2]	Included in the U.S. addendum
Smart Grid	Renewable Energy	High	Low	✓
	T&D Loss	Low	High	✓
	Consumption efficiency	High	Low	✓
Smart Logistics	Road	High	Medium	✓
	Air	Low	Low	
	Ship/Rail/Other	Low	Low	
	Warehouse	Low	Medium	
Smart Buildings	Design	Medium	High	✓
	Technology	High	Medium	✓
Dematerialization	Travel substitution	High	Medium	✓
	Substance (e.g. ePaper)	Low	Low	
Smart Motors	U.S. moving toward a service economy, resulting in a smaller and declining baseline • U.S. factories have largely exhausted the "low hanging fruit" in automation; remaining opportunities difficult to execute			

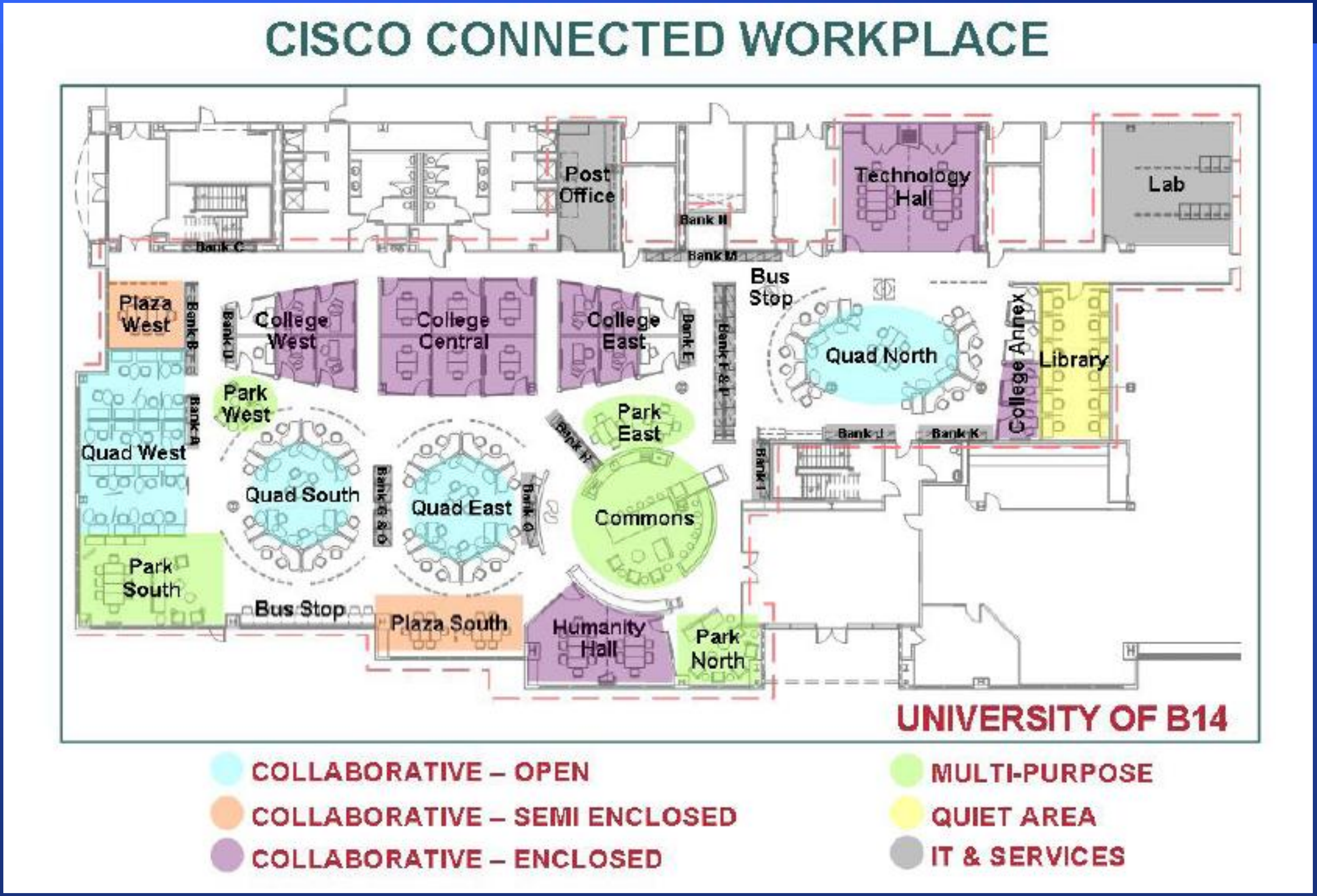
Baseline Range (MMT of CO2)

High = > 1,000
Med = 500 - 1,000
Low = < 500

1. Based on EIA Annual Energy Outlook 2008 and BCG analysis
2. Based on the expected ICT adoption and reduction potential estimates in GeSI and the Climate Group, "Global Smart 2020 report", 2008

Source: "Smart 2020: Enabling the low carbon economy in the information age, United States Addendum", Boston Consulting Group, 2008

Cisco – use less



Source: Cisco

Cisco – use less

Table 1. Cost Savings from the Shared Workspace

Cost Category	Percent Savings
Real estate rent: Accommodating more people in the same amount of space	37%
Construction: Building a smaller space than typically required for 140 employees	42%
Workplace services: Reducing utilities and maintenance costs, and nearly eliminating the costs of moves, adds, and changes for workspaces through the use of flexible furniture settings	37%
Furniture: Purchasing less (and slightly less expensive) furniture than typically used in cubicles	50%
IT capital spend: Spending less on switches and switch ports	40%
Cabling: Reducing the number of wired IP cables required per workspace	60%
Equipment room space: Racking fewer switches because of wireless infrastructure	50%

COSTS:

Design & Visual Communication	$11.70	10%
Construction	59.67	51%
Technology	21.06	18%
Furniture	17.55	15%
Change Management	7.02	6%
Total	$117.00	100%

Source: Cisco

The Coming Wave

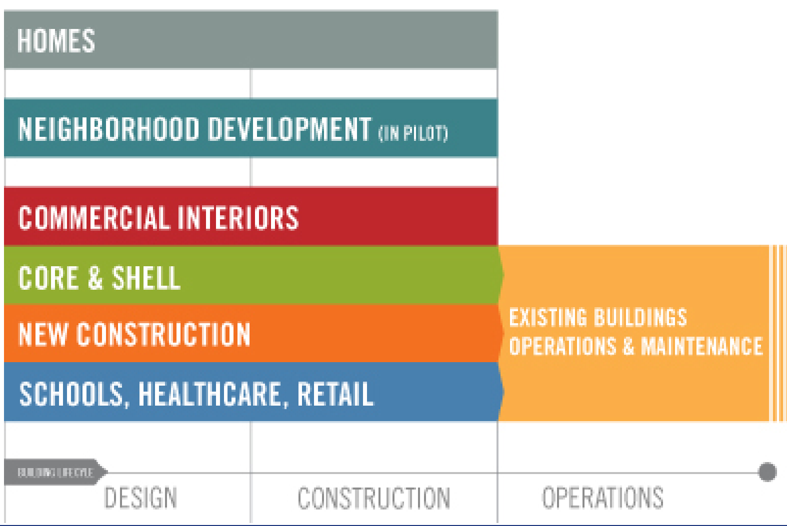
Buildings & Data Centers

US Green Building Council

The U.S. Green Building Council (USGBC) is a 501 c3 non-profit organization committed to expanding sustainable building practices. USGBC is composed of more than 19,500 organizations from across the building industry that are working to advance structures that are environmentally responsible, profitable, and healthy places to live and work. Members includes building owners and end-users, real estate developers, facility managers, architects, designers, engineers, general contractors, subcontractors, product and building system manufacturers, government agencies, and nonprofits.

What is LEED®?

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria.

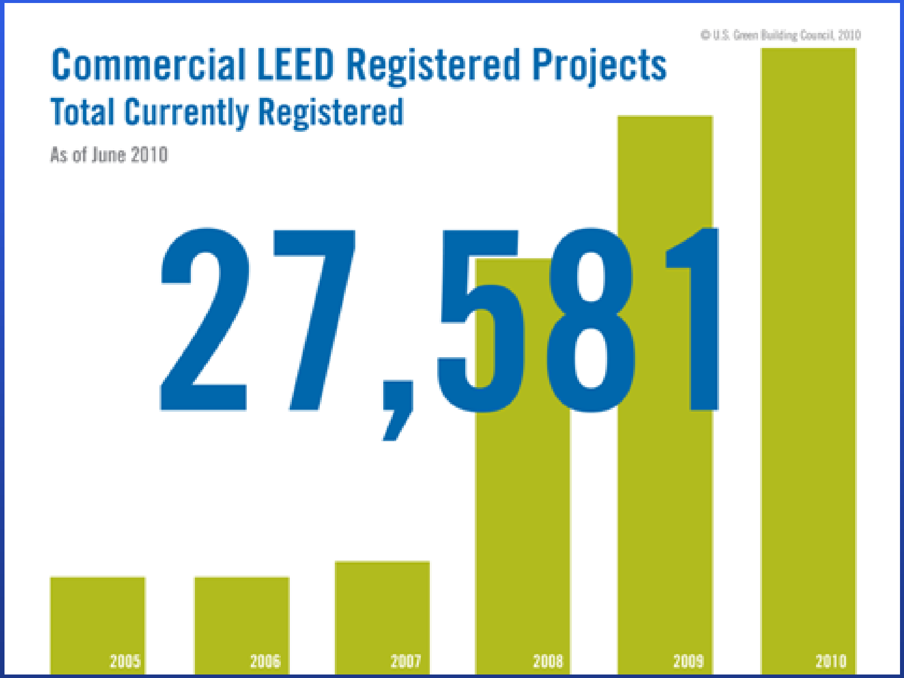


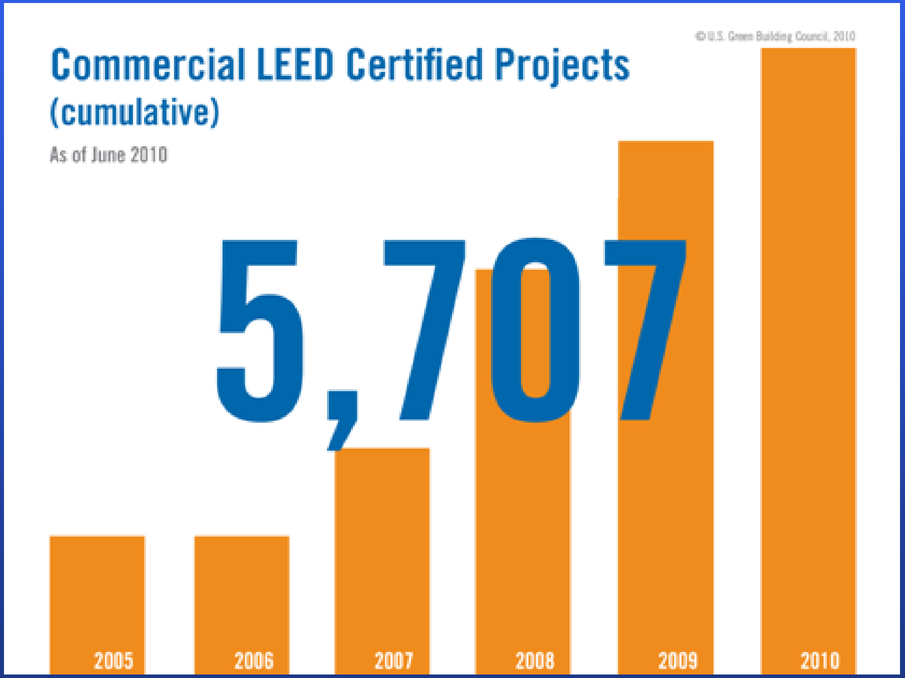
LEED Certification

	Possible Points
Sustainable Sites	14
Water Efficiency	5
Energy & Atmosphere	17
Materials & Resources	13
Indoor Environmental Quality	15
Innovation & Design Process	5
Total	69

Platinum	52 – 69
Gold	39 – 51
Silver	33 - 38
Certified	26 – 32

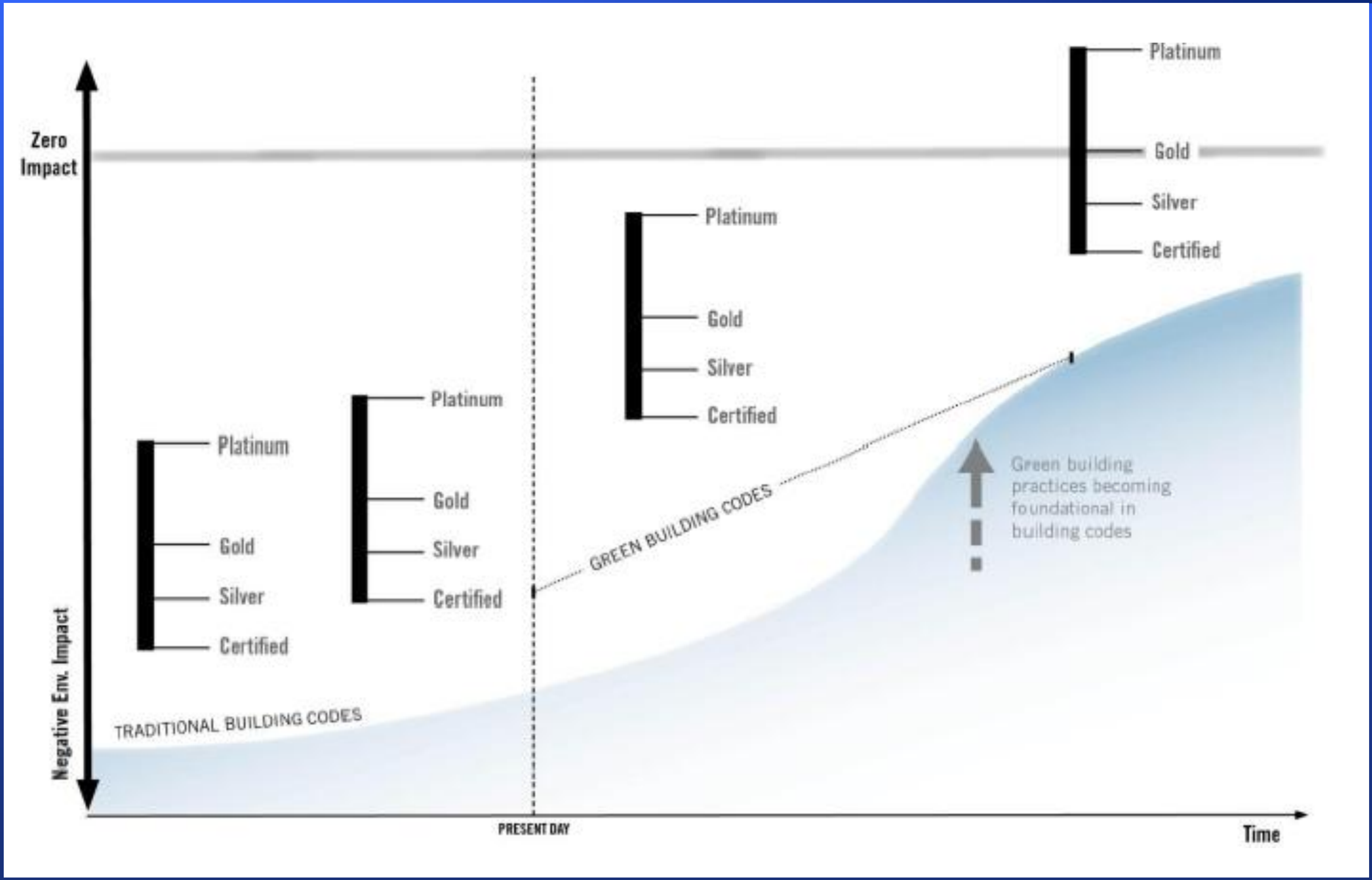
Source: Green Building Rating System for New Construction & Major Renovations





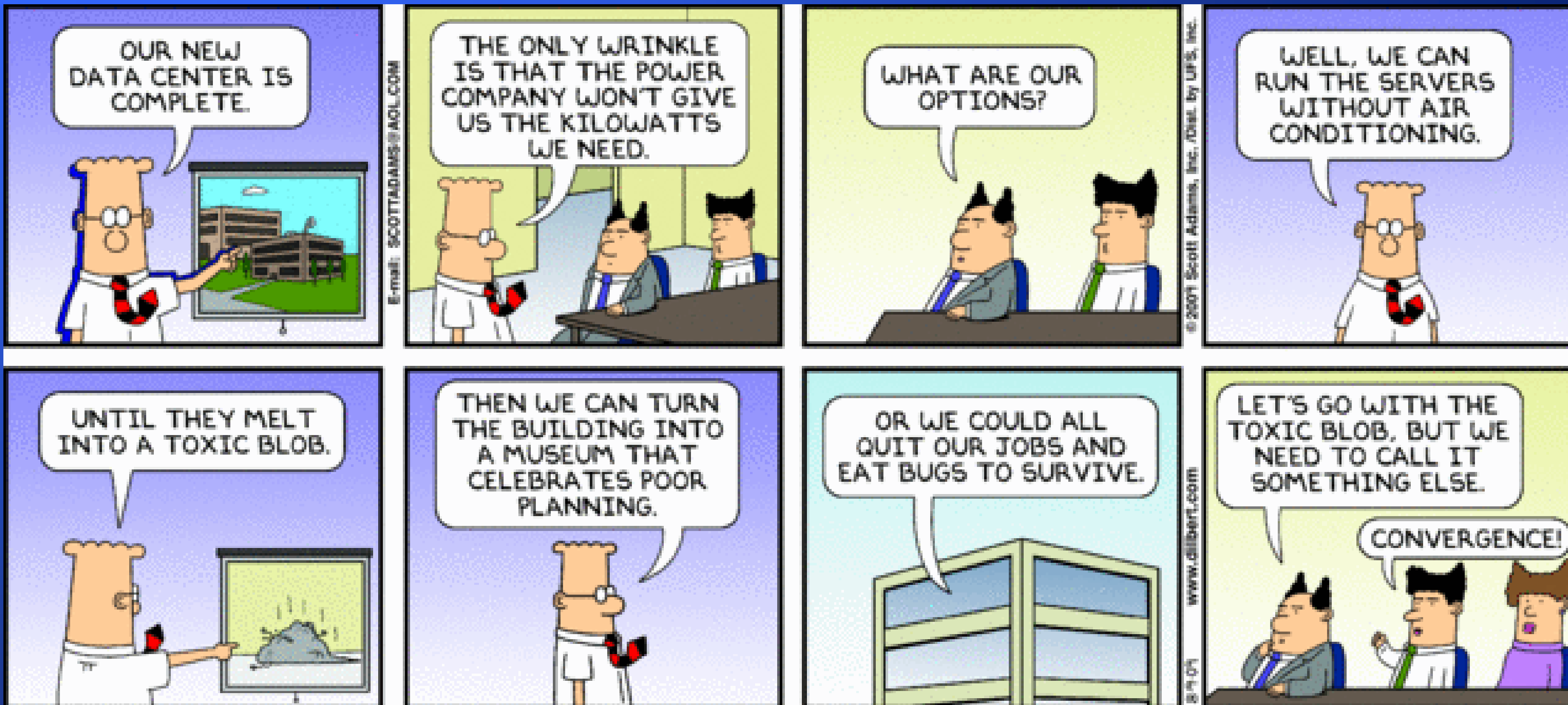
Source: Green Building Rating System for New Construction & Major Renovations

Greening the Building Codes



Source: Greening the Codes, US Green Building Council, 2010

Data Centers



Do CIOs need to understand Real Estate?

CIOs Called Clueless about Extra Costs

IT managers tend to forget about construction and operating costs when they pitch projects, an expert says.

CFO

David M. Katz, CFO.com | US
September 27, 2010

To avoid big overspending by chief information officers, CFOs should order forensic-accounting audits of large information-technology projects, an advocate for data-center efficiency says….

In one case, says Brill, a company decided to invest $22 million in a project to install new data servers. Based on that figure, which was supplied by the IT department, senior management thought the project would yield a "very positive" return on investment, he says. But the tech staffers were unaware that $54 million would be required to install the power and cooling capacity to run the servers and that an estimated $32 million would be needed to operate the servers over their lifetime. As a result, says Brill, they failed to include those extra costs in their pitch. (Also, the overlooked $86 million was accounted for as a cost to the **organization's real estate department**. That helped make the total cost of the project less than transparent, says Brill.)

A big problem stems from a breakdown in the benefits of Moore's Law, which says that the number of transistors that can be placed cheaply on a computer chip will double every two years. Energy efficiency, by contrast, is rising by only a factor of 1.5, says Brill. To fill the gap, data-intensive companies will have to buy scads more electricity to power their data centers. **Indeed, data-center consumption has jumped from 1% of total U.S. electricity use in 2000 to 3% this year, Uptime estimates.**

Green Data Center

Energy Star: Buildings & Data Centers

Energy Star for Buildings: Top 25% in Building Category

February 8, 2010—The U.S. Environmental Protection Agency (EPA) has announced that in 2009, EPA's Energy Star Leaders prevented the equivalent of more than 220,000 metric tons of carbon dioxide and saved more than $48 million across their commercial building portfolios. These savings have quadrupled since 2008 and represent the single greatest year of savings since EPA recognized the first Energy Star Leaders in 2004.

Energy Star for Data Centers:

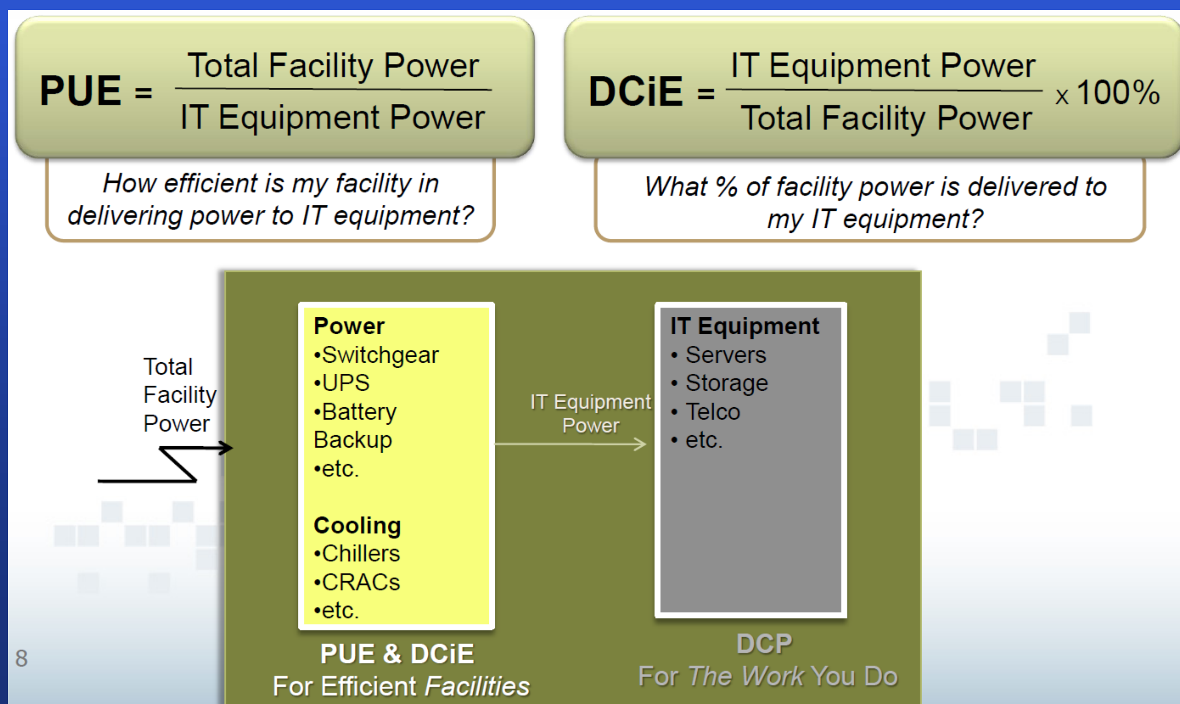
Summary: The voluntary **National Data Center Energy Efficiency Information Program** has been initiated. The Program coordinates a wide variety of activities from the DOE Industrial Technologies Program Save Energy Now initiative, the DOE Federal Energy Management Program (FEMP), and the EPA ENERGY STAR program. The program is engaging numerous industry stakeholders who are developing and deploying a variety of tools and informational resources to assist data center operators in their efforts to reduce energy consumption in their facilities. These groups include, for example: 7 x 24 Exchange, AFCOM, American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Critical Facilities Roundtable, Information Technology Industry Council (ITIC), Silicon Valley Leadership Group, The Green Grid Association, and The Uptime Institute.

Source: http://www.energystar.gov

Data Centers: Emerging Measurements

DCiE – "Data Center Infrastructure Efficiency" is a metric used to determine the energy efficiency of a data center

PUE – "Power Usage Effectiveness" is the reciprocal of DCiE; the typical data center has an average PUE of 2.5; this means that for every 2.5 watts in at the utility meter, only one watt is delivered out to the IT load. It is estimated that most data centers could achieve 1.6 (36% improvement)



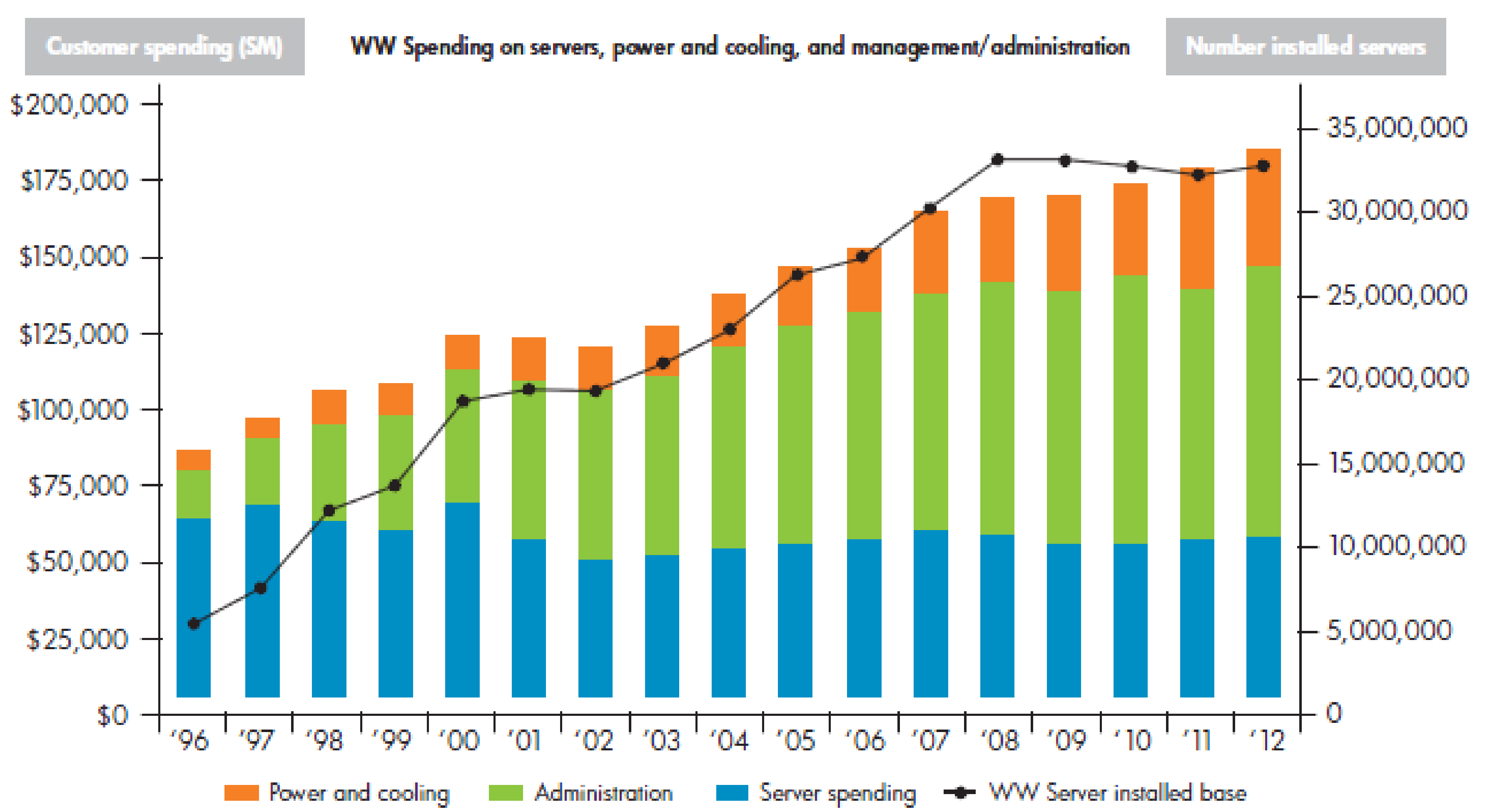
Data Centers: Sample Supporters of PUE

Vendor	Vendor Product	General Market Position	PUE Posture	Qualifiers
HP	Computer servers	Largest server vendor with ~32% share of market	Claims PUE of 1.07 for its POD	Worries there is little consistency in the way PUE is currently measured
Dell	Computer servers	Second largest server vendor with ~22% market share	Claims the highest performance per watt.	PUE and DCiE can be misleading, because they are not designed to capture actual productive work being performed
IBM	Computer servers	Third largest server vendor with ~22%	WebSphere sMash Software monitoring tool	Energy "dashboard" reports PUE and DCiE metrics
Eaton	Power distribution systems (including UPS supplies)	Self-described power management company with $5.9 billion in electrical distribution	Promotes power supply and power distribution efficiency.	Partners with IBM on blade servers PUE is a checklist item on "Power Xpert Reporting v. 2"
Emerson Network Power	Power distribution	Self-described power management company with $5.4 billion in electrical distribution	Avocent subsidiary promotes data center management Software	Management tools model hot/cold aisle temperatures and power consumption
American Power Conversion (APC)	Infrastructure for computer centers	A 2.1-billion euro subsidiary of a 15.8 billion euro power distribution company	Promotes Intelligent energy management with PUE at facility level	InfraStruXure Energy Efficiency application measures kWh consumption "down to the rack level"
Google	Internet service provider	Largest online search tool	Publishes quarterly PUE details. The latest rating is 1.15	Uses highly efficient voltage regulators, but onboard fans and coolers will add more PUE weighting to the IT equipment, by lowering the ratio

PUE = Power Utilization Effectiveness; DCiE = Data Center infrastructure Efficiency; POD = Performance Optimized Data Center, UPS = uninterruptible power supply

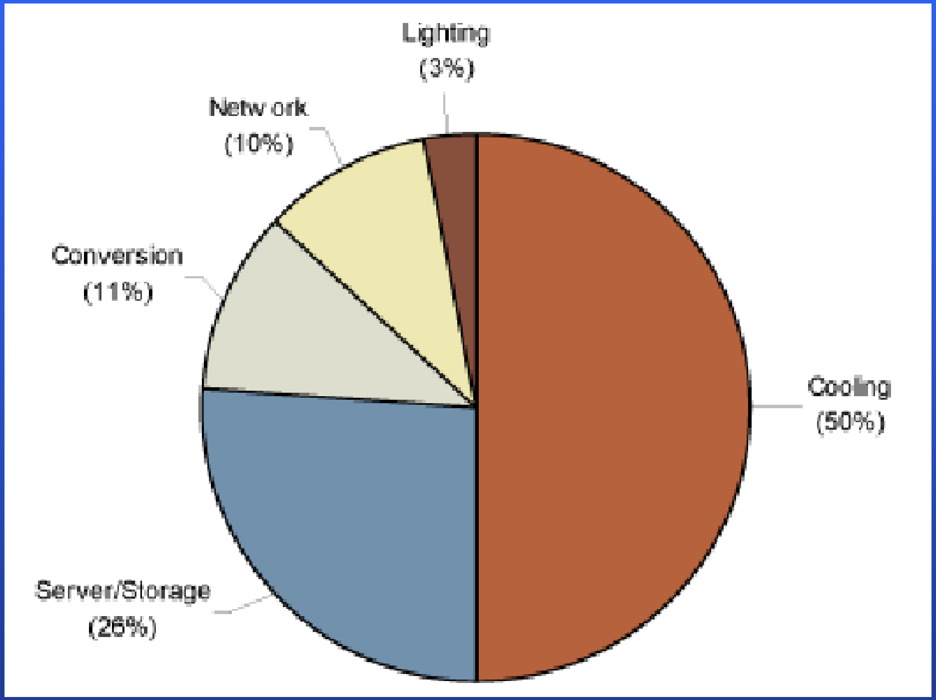
Source: “Market Trends: Sustainability and Cost Savings Objectives for Large Data Centers Will Require Tighter Efficiency Metrics”, Gartner June 2010

Data Center Spending



Source: IDC, 2009

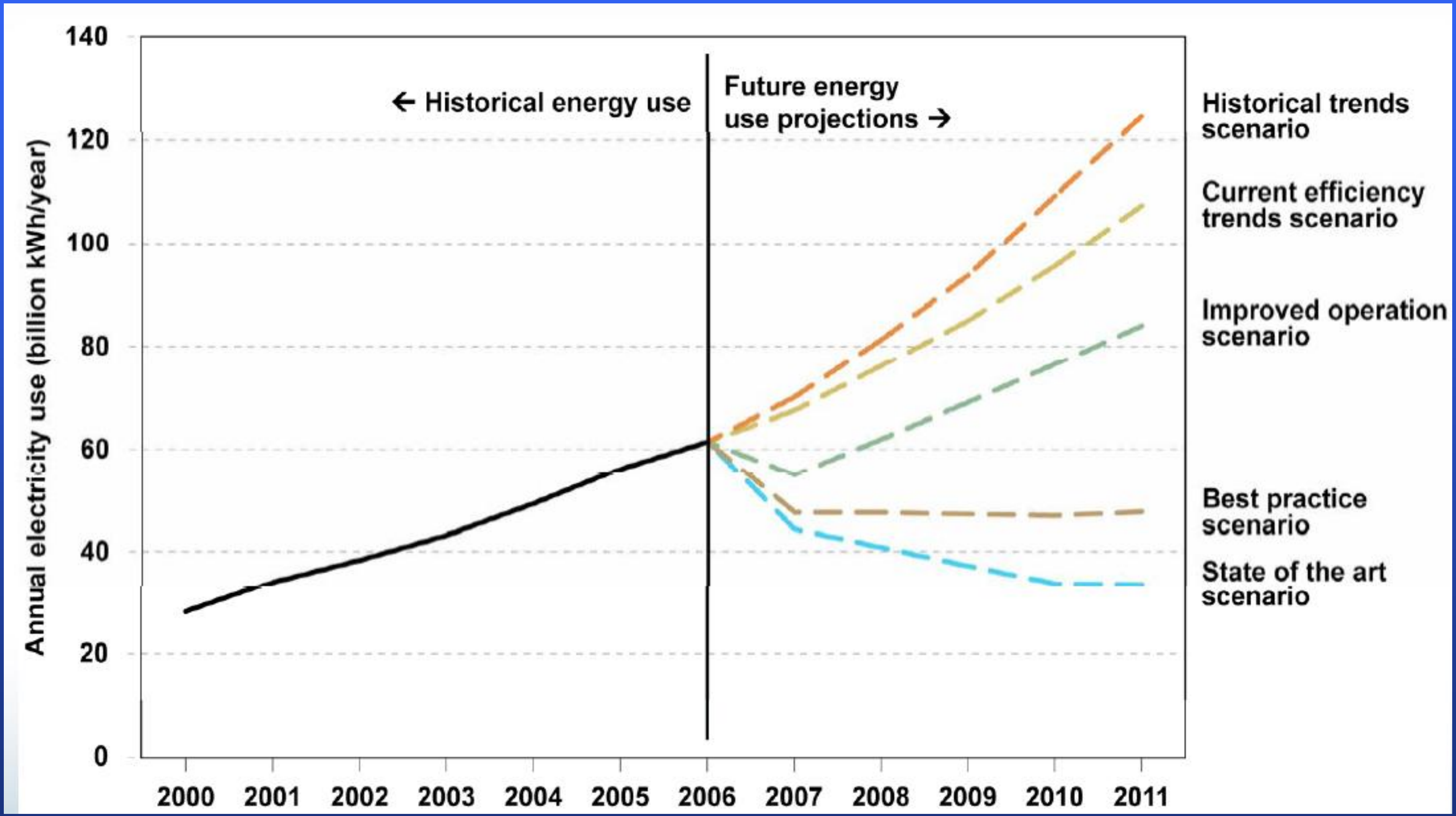
Data Center Spending



Cooling is half the battle

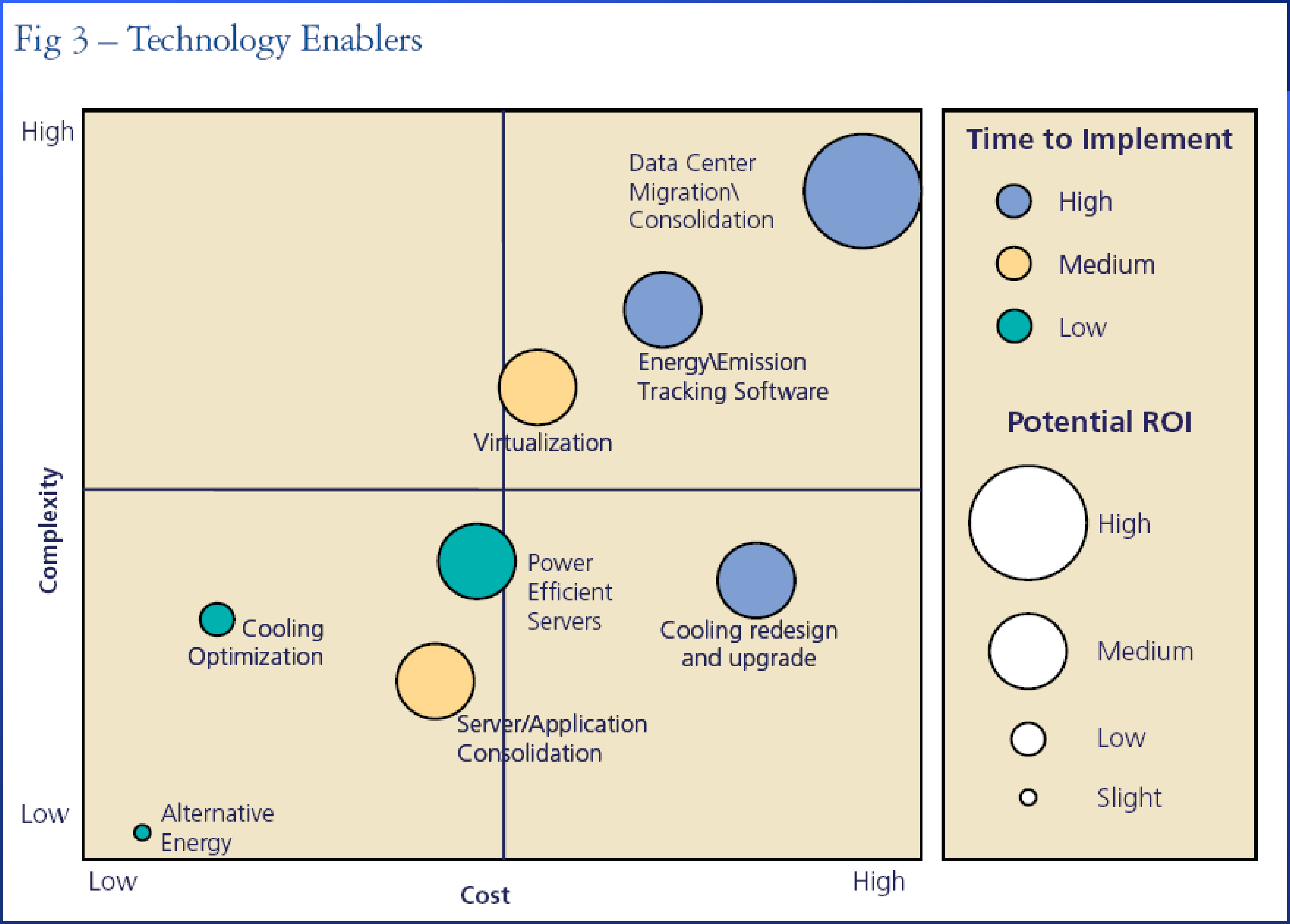
Source: American Power Conversion, Cisco & Emerson Network Power

Data Center Electricity Use Projected



Source: http://www.energystar.gov

Data Center Initiatives



Source: "Green IT", Deloitte Consulting

Critical Gaps: Efficient Data Center Design

- Need to consolidate industry best practices ●●●●●●●●●●●●●●●●●●●
- Integrated energy management (standards, metrics, etc.) Design standard gap – there is no universally recognized nationwide industry standard for energy efficient data centers. What's being measured and how? ●●●●●●●●●●●●●●
- Facilities/IT interface and cooperation ●●●●●●●●
- Pilot projects and test centers reference account savings ●●●●●●
- Charge back based on power: getting real costs allocated correctly ●●●●●●
- Application layer power controls/measurement ●●●●●●
- There is no mpg rating ●●●●●●
- Permanent monitoring IT and utilities. Design and operation optimization ●●●●●
- Knowledge about what you can do (to improve energy efficiency). Need to build knowledge and skills within the company ●●●●●●
- List of key questions C-level project managers should be asking staff ●●●

- Standardized IT work output metric, built-in to equipment service processor ●●●
- Industry is driven by vendors and not end users. Need end user engagement ●●●
- Convergence of IT and facilities organization/technologies ●●●
- Market development (mid-stream) IT and facilities ●●●
- Presenting information and resources back to industry ●●
- Facilities maintenance education ●●
- Lack of energy management standards for data centers to adopt and be certified as meeting standards ●●
- Over design/under design actual redundancy required vs. infrastructure designed impact on efficiency ●
- Triple bottom line business goals and mission ●
- Incentives for implementing energy savings technologies such as DC power ●

- Lack of top management commitment and prioritization - way to make monetary reward obvious to senior executives ●●●●●●●●●●●●
- Lack of financial analytics ●●●●●●●●●●●●
- Disconnect between who uses the energy and who pays for it (as it relates to incentives) ●●●●●●●●●
- Disconnect between fund allocation for first cost vs. operating cost ●●●●●●●
- Lack off information for a compelling business case ●●●●●
- No correlation between energy efficiency and reliability/availability ●●●●
- Incentivize the risk holder ●●●
- Figure out what motivates decision-makers (what rewards matter) ●●●
- True cost of end-user service, i.e., You Tube, Yahoo.com, hotmail.com, My Space. True burden to the beneficiary - flipside to reward - departments, public ●●●
- Federal and state policy/incentive information ●●●
- Broad based will to optimize priority ●●
- Carbon credits ●●
- Incentive not high enough ●●
- Peak demand (kW) vs. energy savings (kWh) ●●
- Management involvement and leadership of data center costs and performance ●●
- How persistent are the rewarded savings? ●●
- Facts tell - stories sell, we need to market ●
- Consistency among various industry recognition programs - Leed, Energy Star, Uptime ●
- Why? What's in it for me? ●
- Career risk ●

- Link facility manager with IT managers
- Wrong stakeholders - what's in it for me (CFO level)
- Pain (lack of pain)
- User knowledge in energy efficient technology implementation and consumption management
- Transparency (vendor - influenced incentives)
- Reach consensus as a community
- People are too busy
- Lack of technical knowledge
- Simple understandable incentives
- Need to assess risk
- Make profits the ultimate reward
- Design program on technology, control, or behavior basis or combo
- Reward a product or system - both
- Utilities don't have standards to determine absolute energy savings, i.e., what is the right baseline
- Timing of incentives
- Persistent energy incentive programs
- National monetary award recognizing top 20 data centers for efficiency design or efficiency improvements
- Reconciling capacity and performance growth rates with energy costs
- Visible comparisons to peers/competitors - benchmarks
- Tracking fine grained energy per server and service

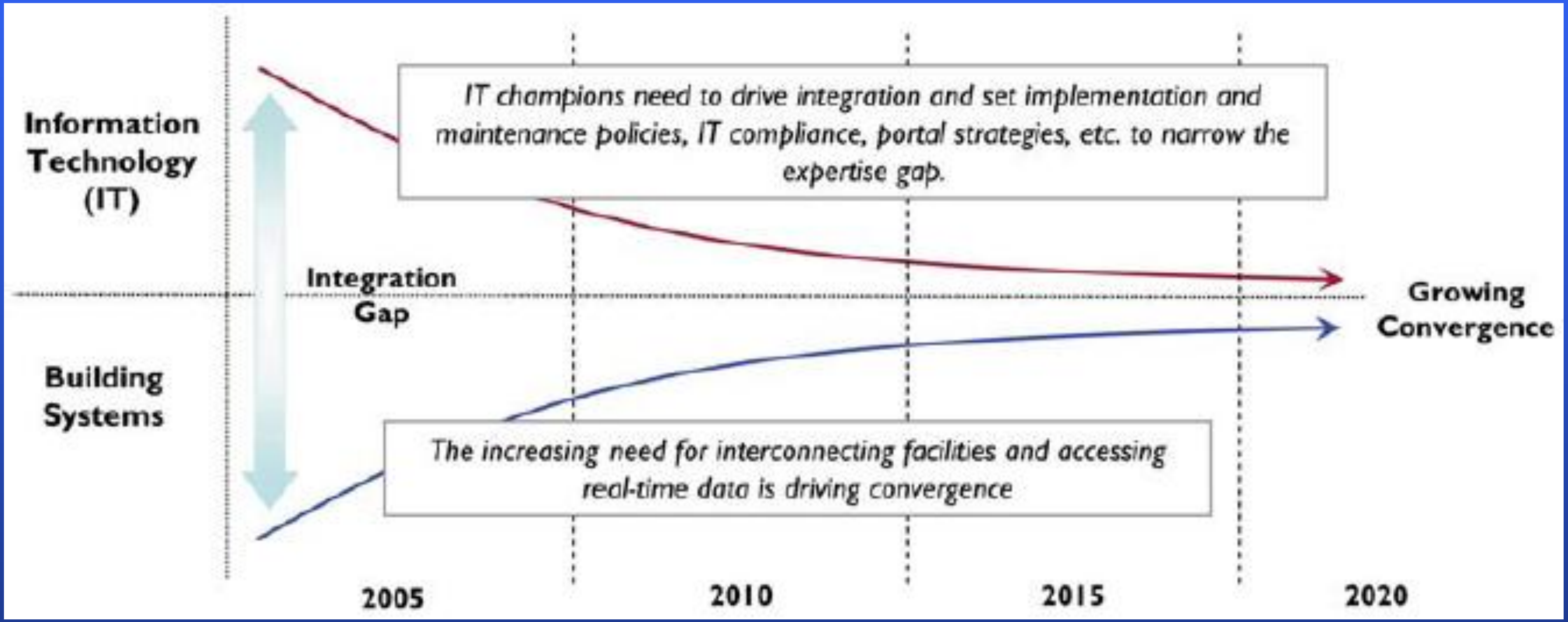
(● = Most Critical Gap)

Source: National Data Center Energy Workshop Strategy Workshop, EPA, Sep. 2008

The Coming Wave

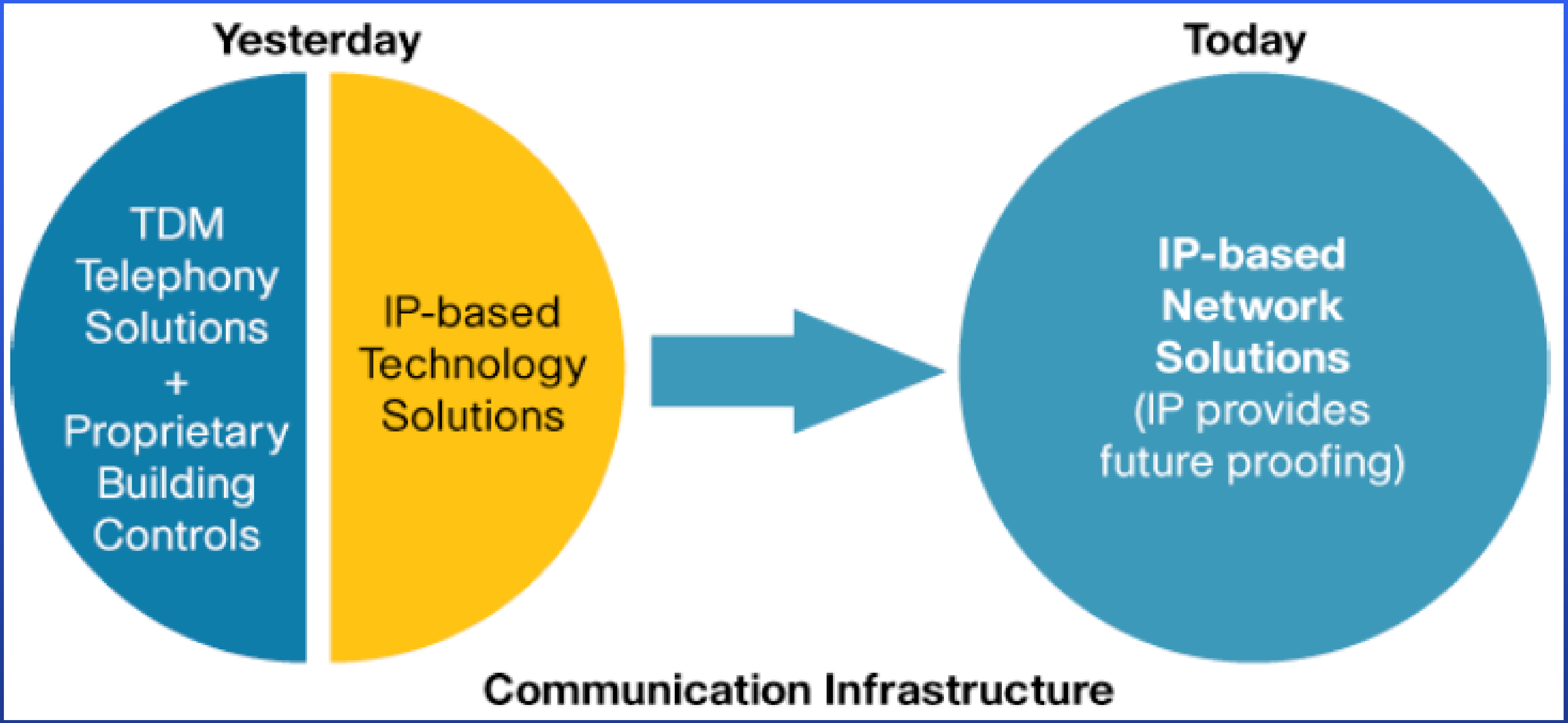
Real Estate & IT Convergence

Technology, IT Technology and Building Controls Converge



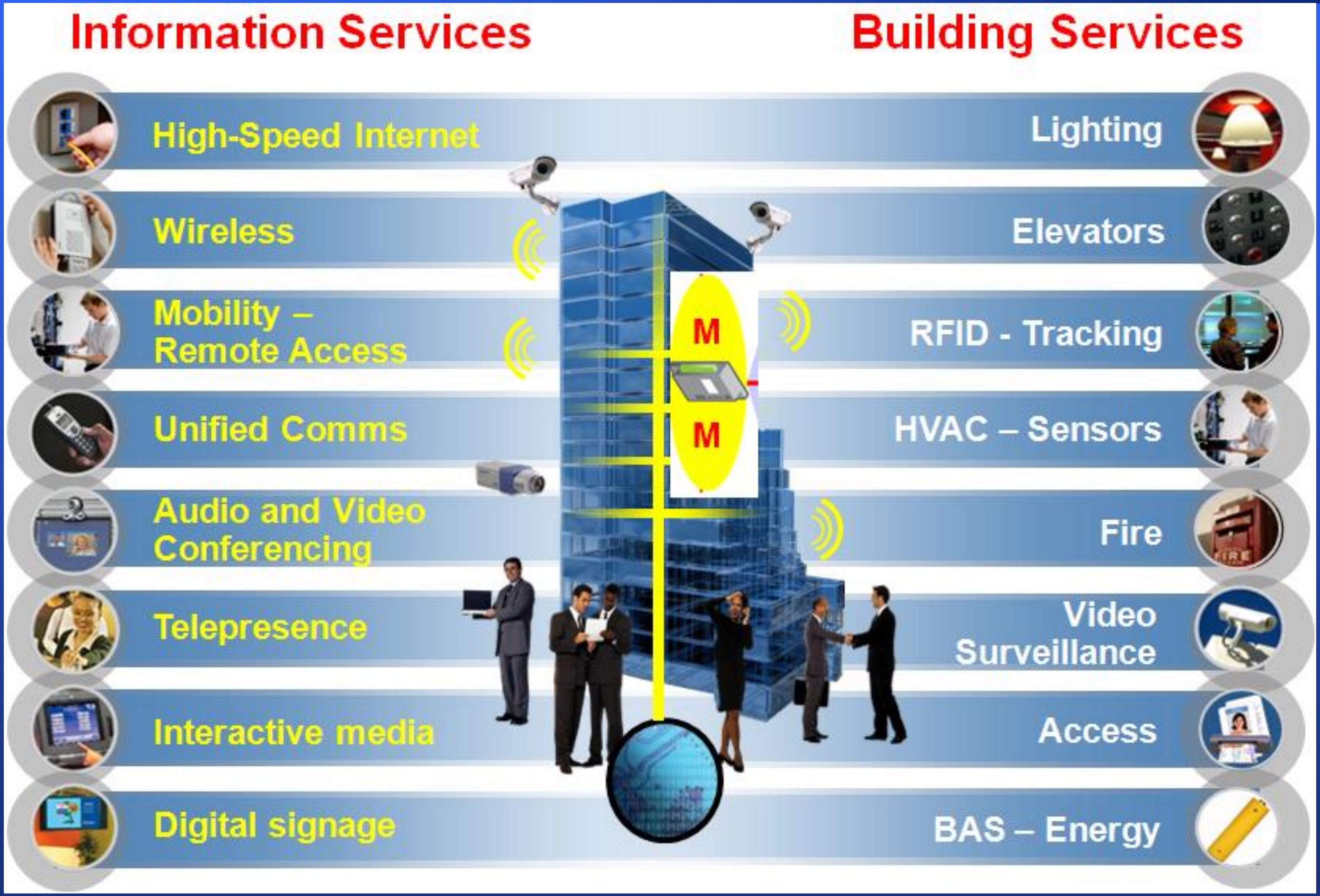
Source: A New Facelift for Existing Buildings, Frost & Sullivan

Technology, IT Technology and Building Controls Converge



Source: Real Estate Today: A Market Transformation, Cisco, 2008

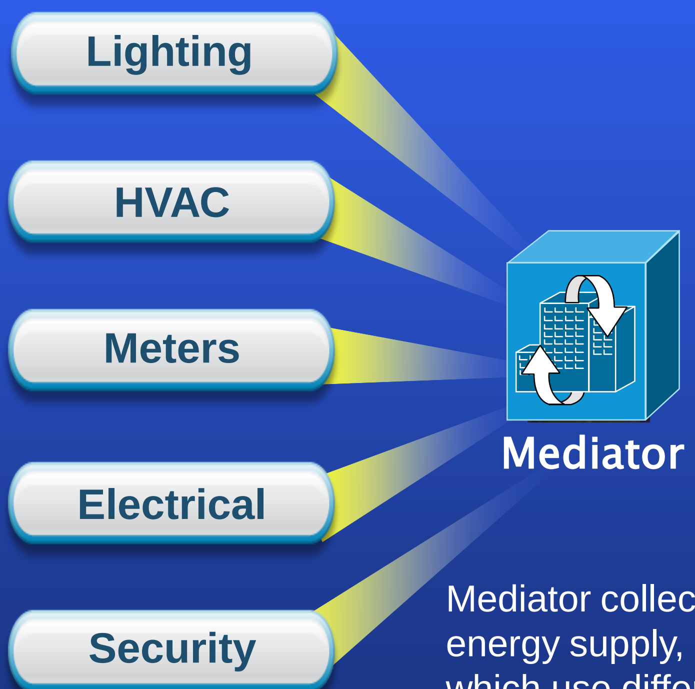
Convergence: The Building Information Network



Source: Cisco Connected Real Estate, 2010

Convergence: Cisco Mediator (Richards Zeta)

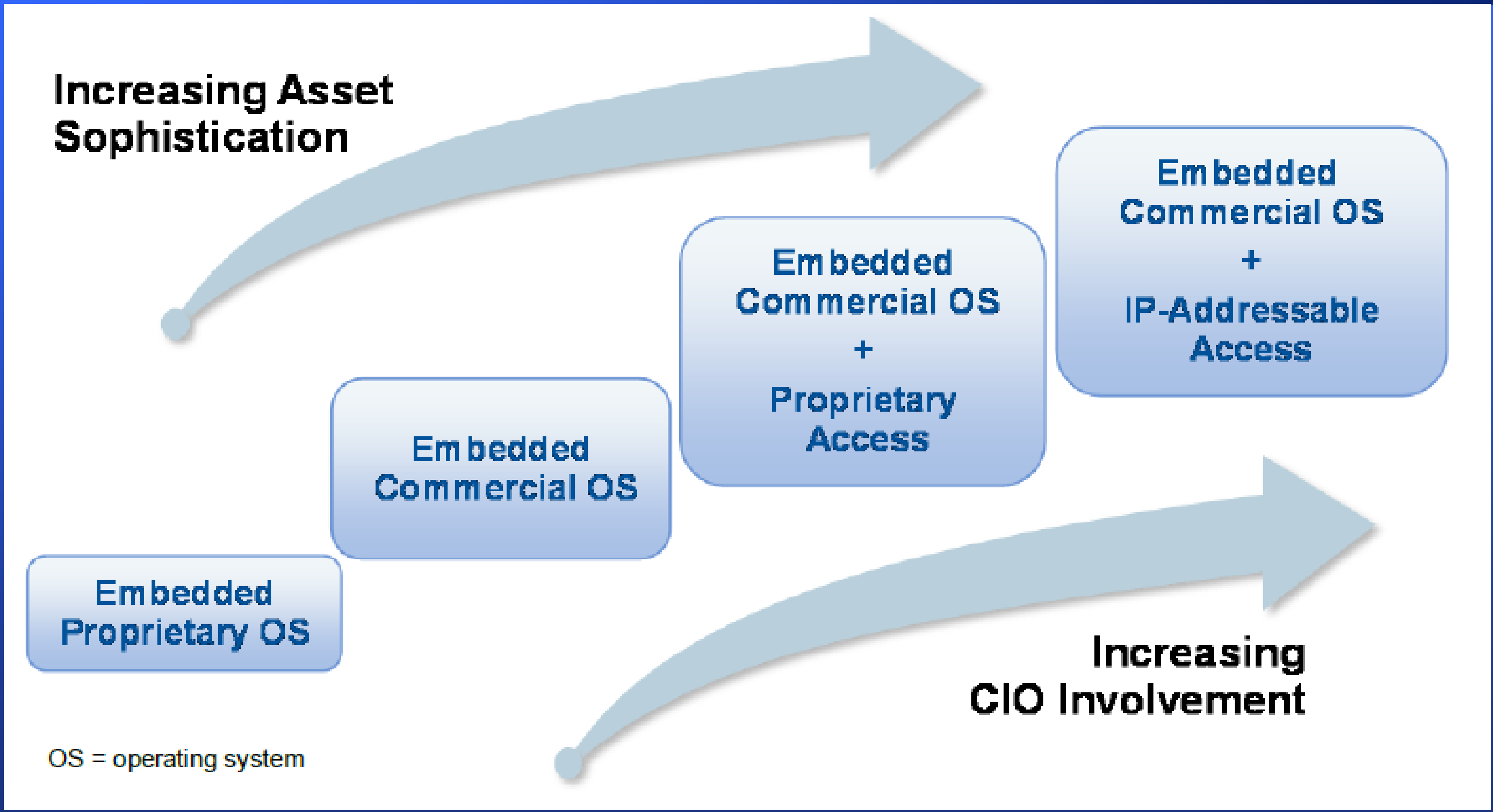
Building Systems | **Applications that Lower Costs**



Mediator collects data from the building, IT, energy supply, and energy demand systems, which use different protocols and are otherwise unable to communicate.. Mediator product is an extension to the IP Network.

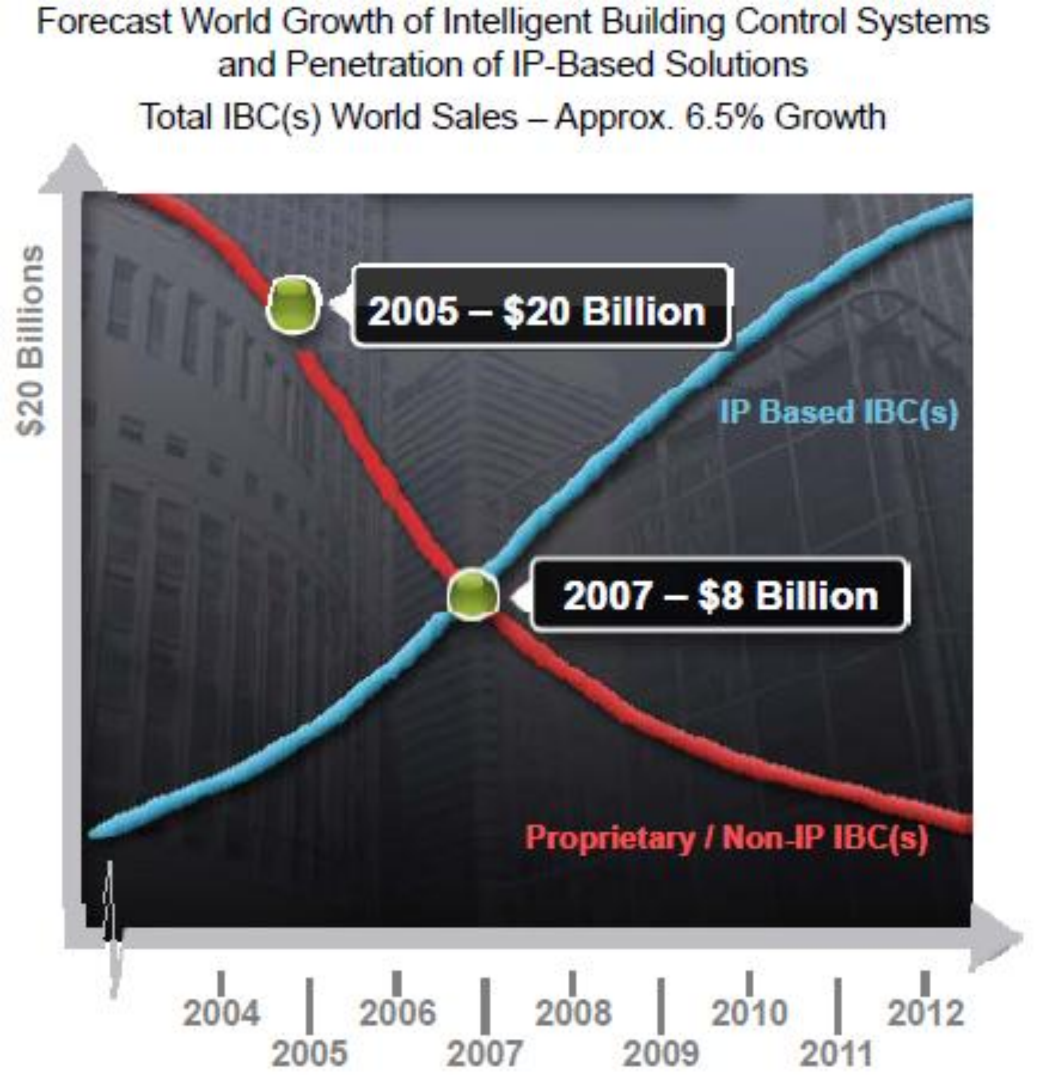
Source: Cisco Connected Real Estate, 2010

Convergence: Operational Technology & IT



Source: “Operational Technology Convergence With IT: Definitions”, Gartner, July 2010

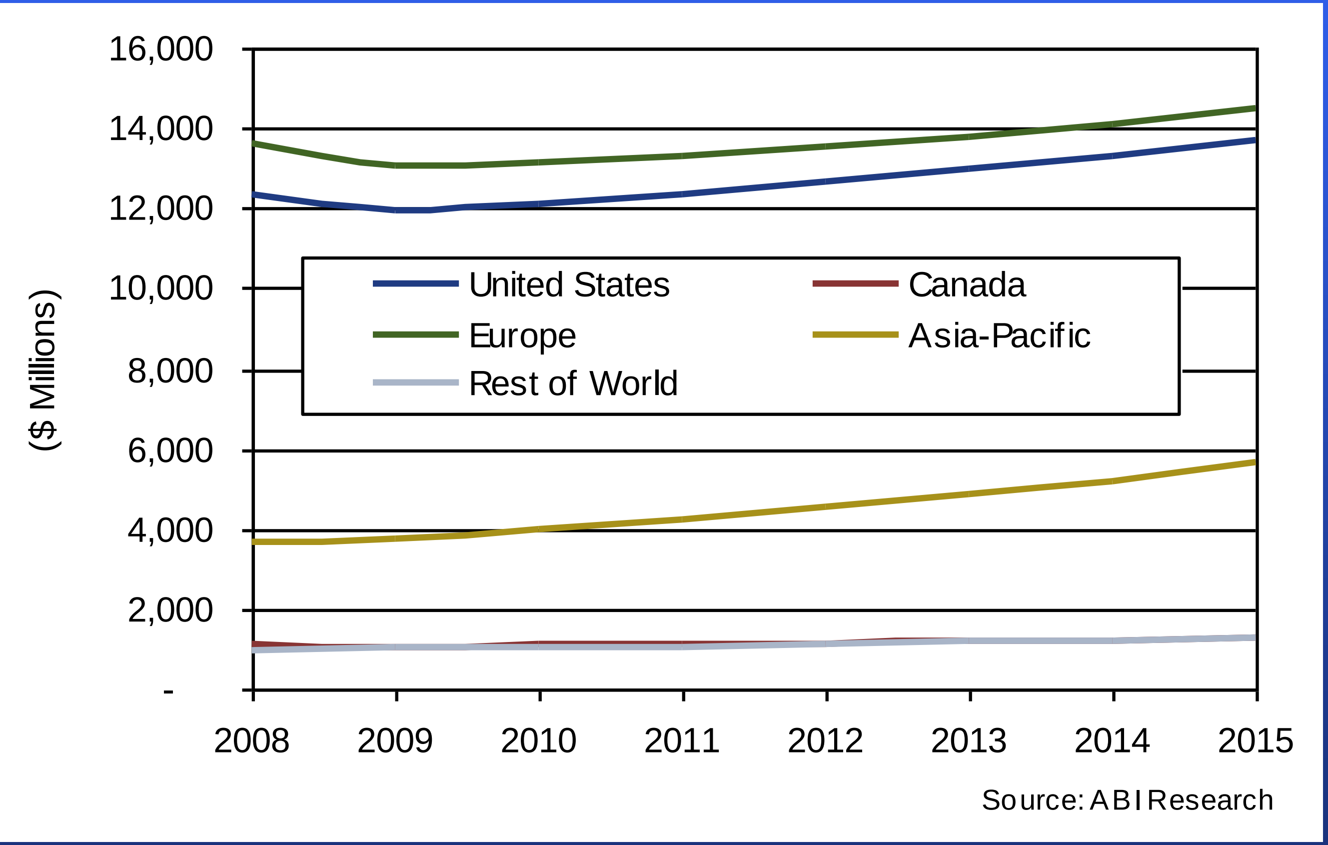
Convergence: Projected IP based BCS



Source: IT-Convergence in Buildings, i&I Limited Proplan, 2006

Building Automation System Revenue by Region

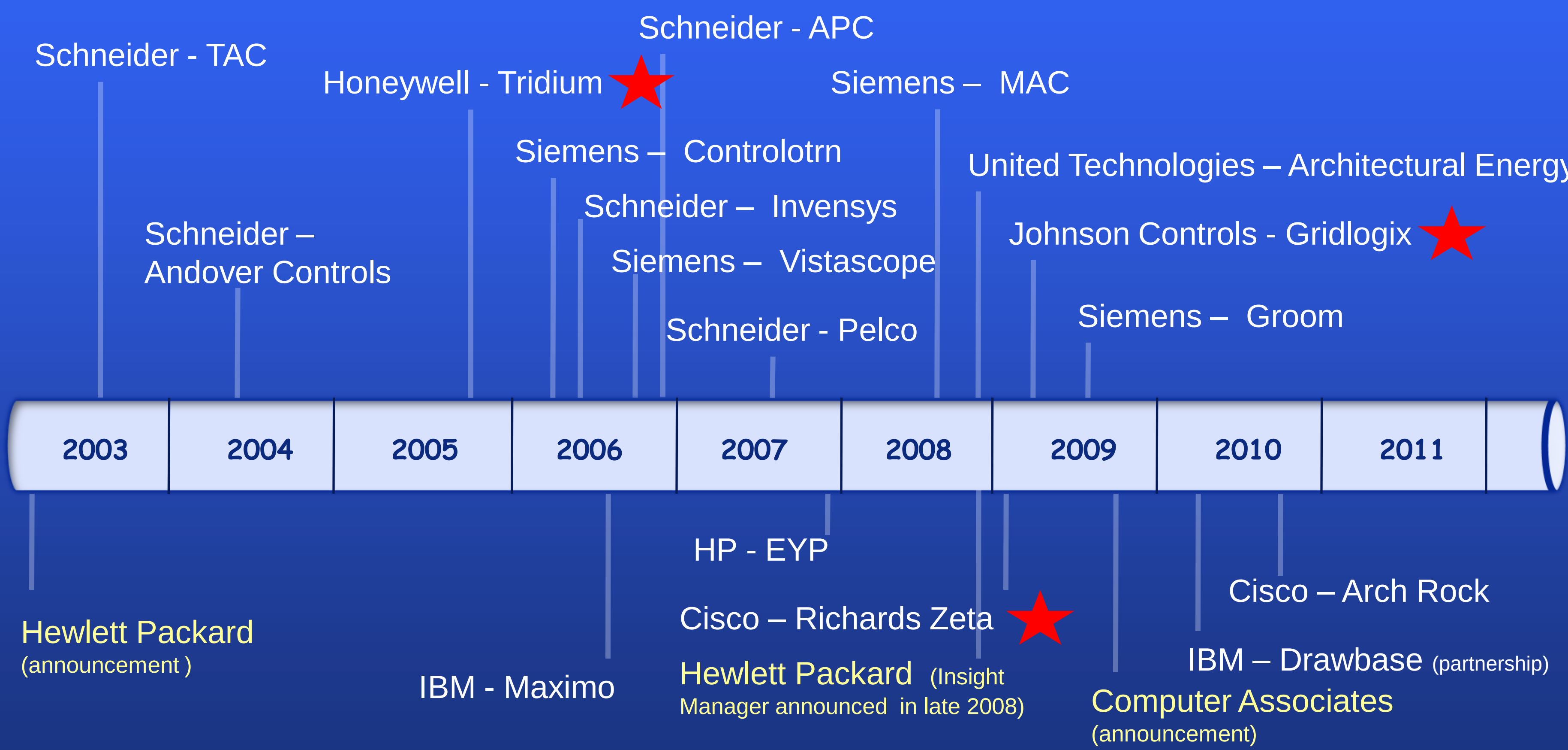
World Market, Forecast: 2008 to 2015



Source: Energy Management and Commercial Building Automation, ABI Research , First Quarter 2010

Convergence: Some Market Evidence

Manufacturing or Electronics Company Acquisitions



Technology Company Acquisitions

★ => “Middleware”

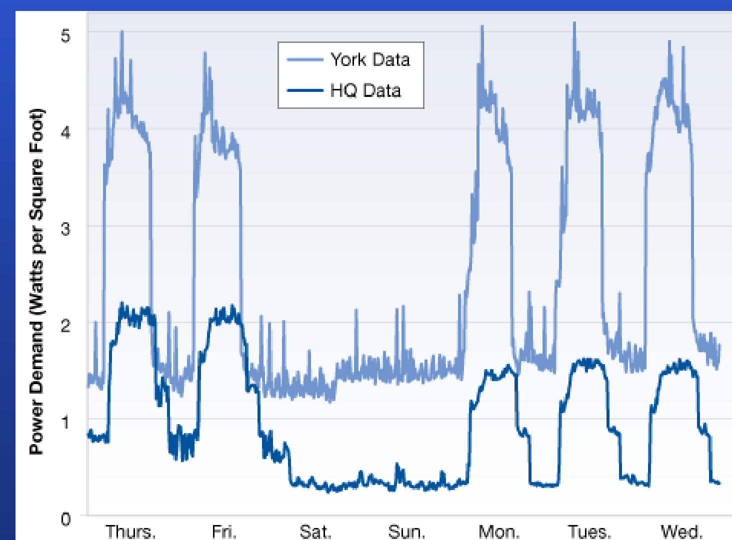
Note: Both Microsoft and Google announced energy management applications for consumers in 2009

Example

Technology	Benefit	Comment
PV panels	Direct emission and energy reduction	1,452 solar PV panels make up one of the largest arrays in Wisconsin, delivering up to 250 kW of emission-free electricity to the site.
Geothermal heat pumps	Direct emission and energy reduction	272 boreholes source natural waters for heating and cooling applications.
Under-floor heating	Indirect (energy reduction)	Produces efficient and uniform heating.
Skylights and bigger windows	Indirect (reduced lighting and improved working environment)	As well as reducing energy consumption, natural lighting additionally provides for a better working environment.
Rainwater collection	Indirect (reduced municipal water consumption)	A 30,000-gallon cistern captures rainwater for "brown water" applications, such as irrigation and flush toilets, reducing potable water consumption for new bathroom fixtures by 77% or 595,000 gallons. Collection included a parking-lot surface with permeable pavers.
Solar thermal	Direct (reduced energy and emissions)	A 1,330-square-foot solar thermal installation on the roof annually saves an estimated 2.8 kilo therms* of energy.
Building information management system	Indirect (collection, analysis and optimization of building subsystems)	There was coordination of all activities across the facilities as well as provision of a single point of access to performance indicators and control of subsystems using the BIM system Metasys.

* Therm (U.S.) = 100,000 BTUs (105 M Joules, 29 kWh)

" … it can be estimated that the annual electricity consumption demand of the York and HQ buildings are 21.9 and 6.3 kWh/sq. ft. per year, respectively. In other words, energy-efficiency retrofit demonstrates about a **71% improvement** on a "business as usual," conventional-building consumption pattern"



Note: Data based on a per-square-foot consumption basis and collected on a 15-minute frequency.

Source: "An Energy-Efficiency and Sustainable Buildings Case Study: Johnson Controls Demonstrates Leadership in Design and Execution", Gartner, Oct. 25, 2010

The Coming Wave

Questions & Answers

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