Addressing Data Center Efficiency
Lessons Learned From Process Evaluations of Utility Energy Efficiency Programs

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Agenda

Intro to Data Centers

A New Opportunity for Savings

Challenges

Identified Barriers in a New Industry

Lessons Learned

Results from Research and Evaluation

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What is a Data Center?

Facilities housing high-power Information Technology (IT) equipment

➡ Computer Servers
➡ Data Storage
➡ Networking Equipment

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Why Focus on Data Centers?

Energy Use is Large and Growing!

➡ 1% of worldwide energy consumption[1]

➡ 12% yearly energy growth worldwide[1]

➡ In Western Europe

 – 56 TWh in 2007, expected to rise to 104 TWh in 2020[2]

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1. Source: Worldwide Electricity Used in Data Centers, J. Koomey 2008.
2. Presentation: *The New European Policy for Energy Efficiency in Data Centres: The Code of Conduct.* P. Bertoldi. 2009.

Why Focus on Data Centers?

Extremely Energy Dense!

➡ Up to 40X a typical commercial office building[1]

➡ Opportunity for <u>concentrated energy savings</u>

Energy Intensity (W / sq. ft.)
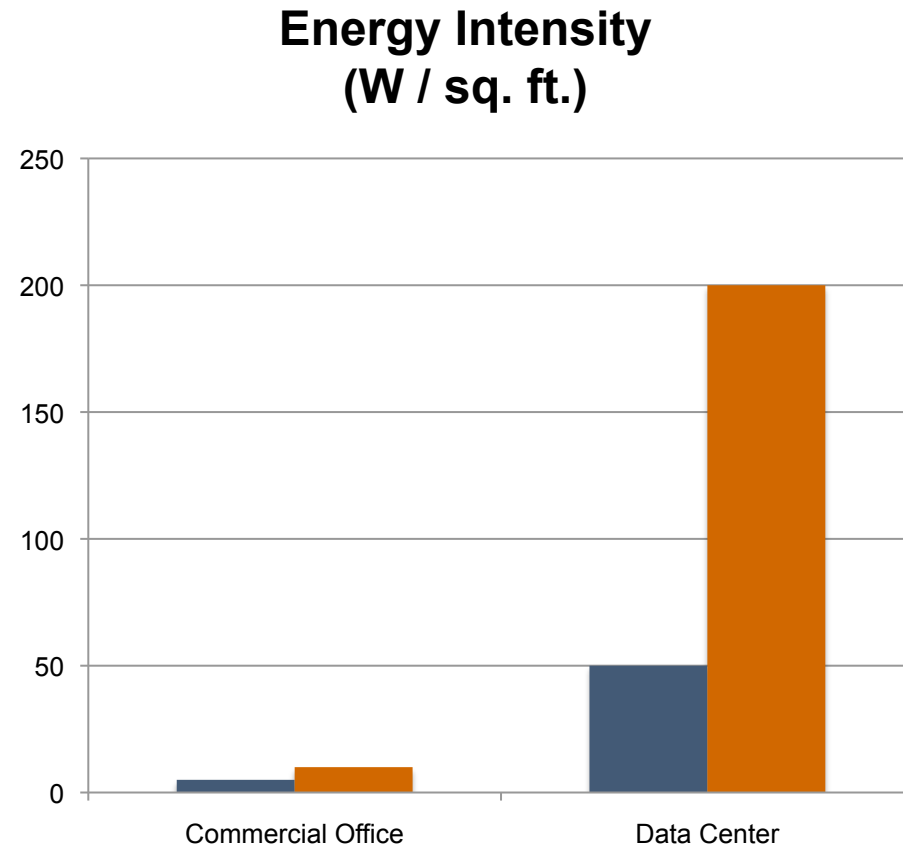
1. Source: Best Practices for Data Centers: Lessons Learned from Benchmarking 22 Data Centers, Greenburg et al, 2006.

Size and Energy Use by Type

Type	Footage	Servers	Description	Percent of Energy Use
Server Closet	<200 ft^2	One to two	No external storage, office A/C, May have UPS	12%
Server Room	<500 ft^2	A few to dozens	No external storage, office A/C, May have UPS	16%
Localized Data Center	<1,000 ft^2	Dozens to hundreds	Moderate external storage, in-room cooling, raised floor, UPS	18%
Mid-Tier Data Center	<5,000 ft^2	Hundreds	Extensive external storage, in-room cooling, central chiller, high reliability UPS	16%
Enterprise-Class Data Center	5,000+ ft^2	Thousands+	Thousands of storage devices, efficient cooling and backup subsystems	38%

Where Does the Power Go?
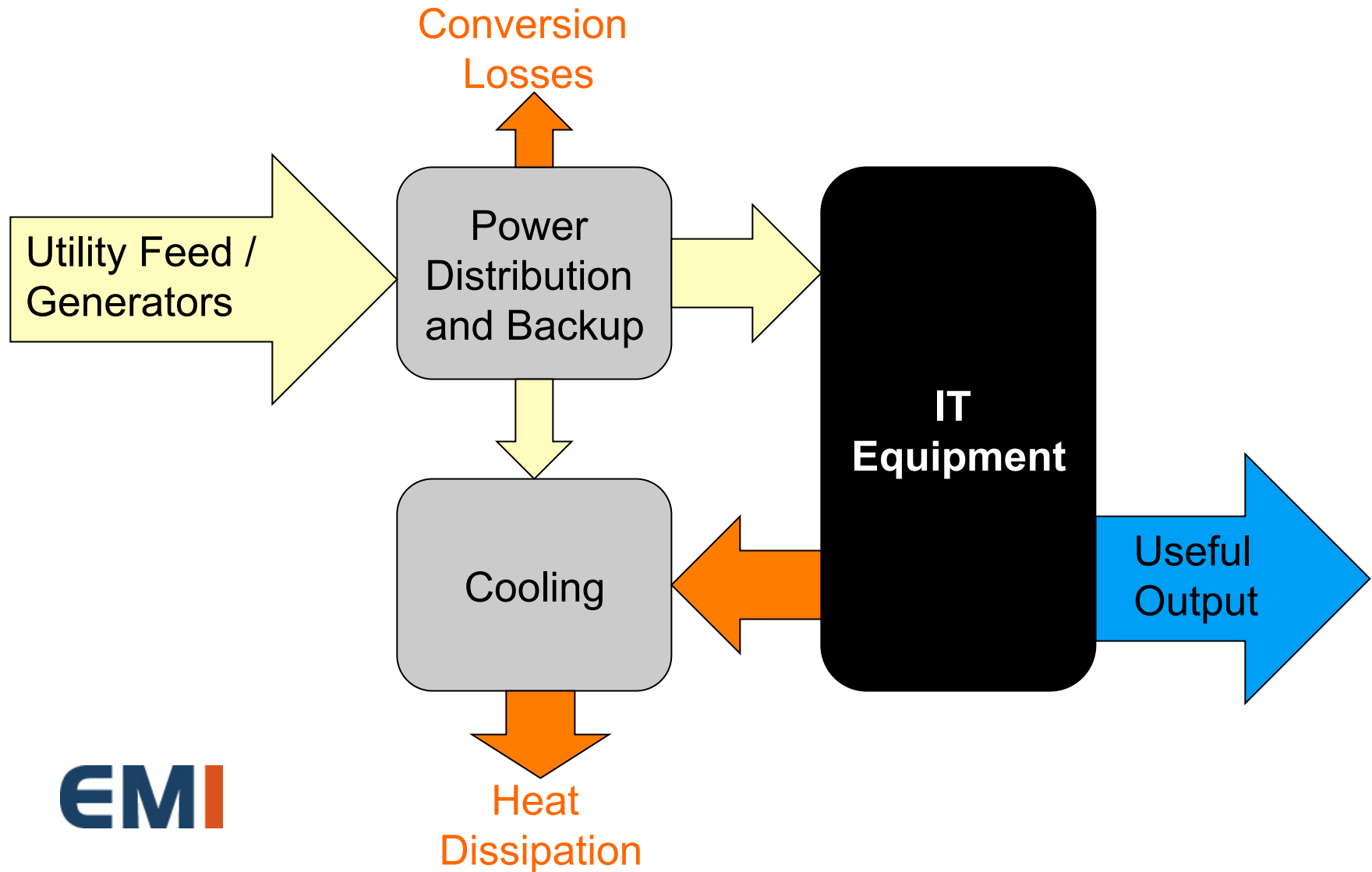
Where Does the Power Go?

Facilities Power

IT Power

~ 50%

To Power Distribution, Backup and Cooling
•PDU
•UPS
•Chillers
•Air Handlers, etc.

Power Distribution and Backup

Cooling

IT Equipment

~ 50%

To IT Equipment:
•Servers
•Storage
•Networking

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ENERGY STAR & DOE

U.S.
EPA

Existing Specifications	Specifications Under Development
Enterprise Servers V1.0 Computers V5.0 Data Center Rating V1.0 (June 2010)	Enterprise Servers V2.0 Data Center Storage V1.0 Uninterruptable Power Supplies (UPS) V1.0 Small Networking Equipment V1.0

U.S. Department of Energy (DOE)

➡ Certified Practitioner Program

➡ DC Pro Software Tool Suite

➡ American Recovery and Reinvestment Act

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European Activities

➡ European Commission Code of Conduct (CoC) for data centers

➡ EC Adoption of ENERGY STAR Specifications

➡ Efficient-Servers Initiative by the Austrian Energy Agency

➡ Individual Country Efforts – e.g., Environment and Energy Management Agency in France

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Where Do Utilities Come In – Available Programs

Holistic Data Center
• Engineering Support / Technical Assistance
• Efficiency Feasibility Studies or Energy Audits

Cooling	Power	IT	Other
• Chillers / HVAC / Economizers • Air Flow Management • Advanced Controls • VFDs	• UPS • PDU • Transformers • Inverters	• Efficient Servers • Efficient Power Supplies • Server Virtualization • Storage Virtualization (e.g., MAID)	• Lighting • Efficient Computers • PC Power Management • Plug Load Management

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What is the Target Market?

➡ Who qualifies?

➡ Where do you spend your marketing dollars?

High-Tech Companies	IT Heavy Companies	Commercial & Industrial
IT/Internet Companies (e.g., Google, MSFT, Intel, Amazon)	Financial Services, Health Care, Engineering, Labs, etc.	Retail, Office Space, Manufacturers, etc.

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Where are the Data Centers?

Other Challenges

➡ Rapidly changing technologies & markets

➡ Extreme focus on reliability

➡ Split incentive

➡ Knowledge gap between program designers (i.e. utilities) and data center industries

➡ Capital intensive upgrades

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A Special Challenge: Colocation Facilities

Growing faster than many industries

➡ 15% annualized growth[1]

Identified Barriers to Energy Efficiency

➡ Aggravated split incentive

➡ Pricing models

➡ Focus on reliability

➡ Reaching the colocation customers

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Source: *Tier1 Research Datacenter Market Trends (Presentation to the CFRT 11/6/2009)*

Lessons Learned

Treat Data Centers Differently!

➡ Targeted programs & outreach

➡ Effectively communicate program opportunities

➡ Understand specific barriers and decision making practices

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Other Resources

AFCOM
- http://afcom.com

Consortium for Energy Efficiency Program Database
- http://www.cee1.org/com/dcs/dcs-main.php3

Database of State Incentives for Renewable and Efficiency
- http://www.dsireusa.org

Data Center Dynamics
- http://datacenterdynamics.com

DOE
- http://www.eere.energy.gov/datacenters

ENERGY STAR
- http://www.energystar.gov/datacenters

The Green Grid
- http://www.thegreengrid.org

LBNL
- http://hightech.lbl.gov

Uptime Institute
- http://www.uptimeinstitute.org/
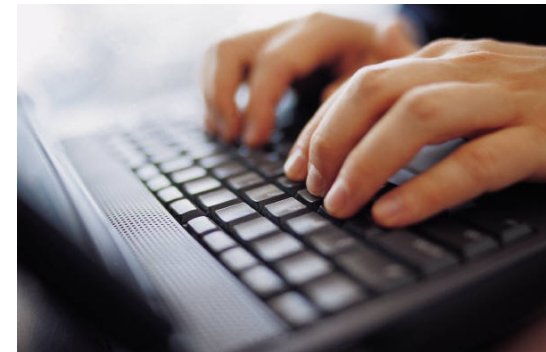
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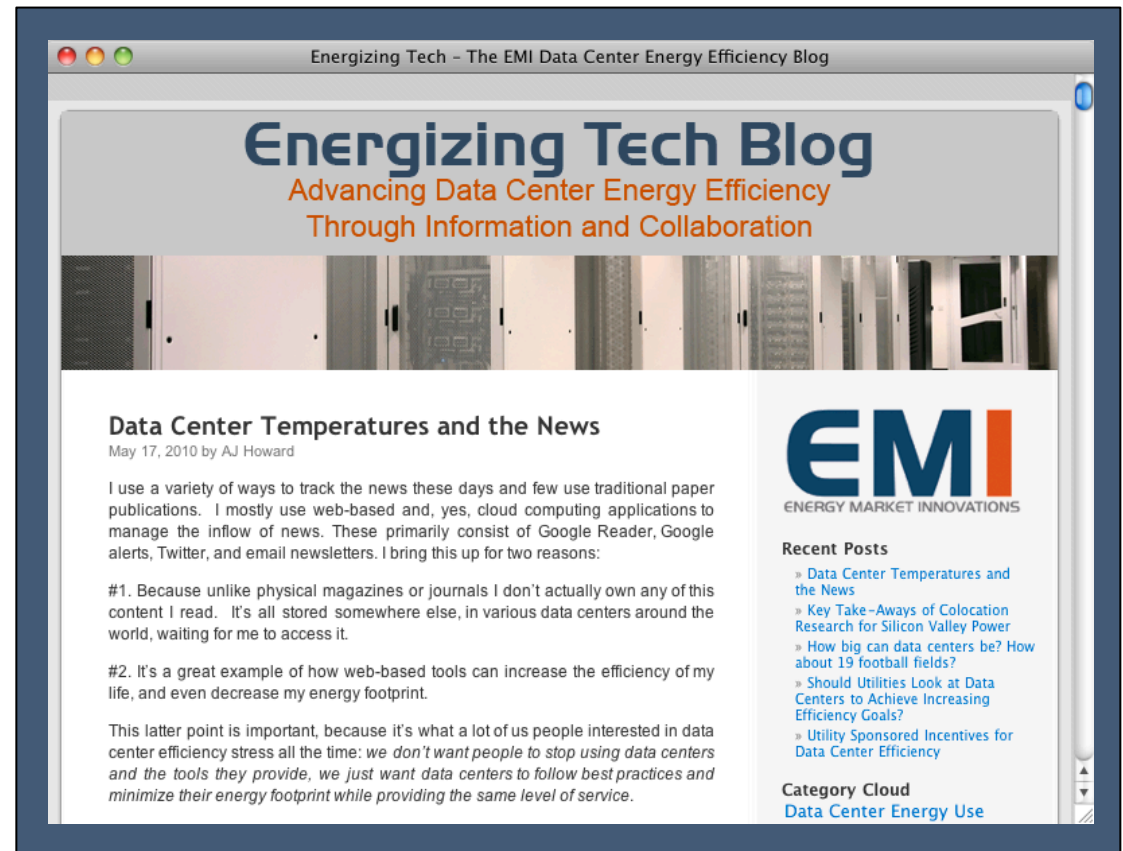
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