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

IEPEC Conference
Session 16: Industrial Strength Evaluation
June 10, 2010

AJ Howard
Energy Market Innovations (EMI), Inc.
ajhoward@emi1.com



Agenda

Intro to Data Centers

A New Opportunity for Savings

Challenges

Identified Barriers in a New Industry

Lessons Learned

Results from Research and Evaluation

What is a Data Center?

Facilities housing
high-power
Information
Technology (IT)
equipment

- ➔ Computer Servers
- ➔ Data Storage
- ➔ Networking Equipment



Why Focus on Data Centers?

Energy Use is Large and Growing!

→ 1% of worldwide energy consumption¹

→ 12% yearly energy growth worldwide¹

→ In Western Europe

– 56 TWh in 2007, expected to rise to 104 TWh in 2020²



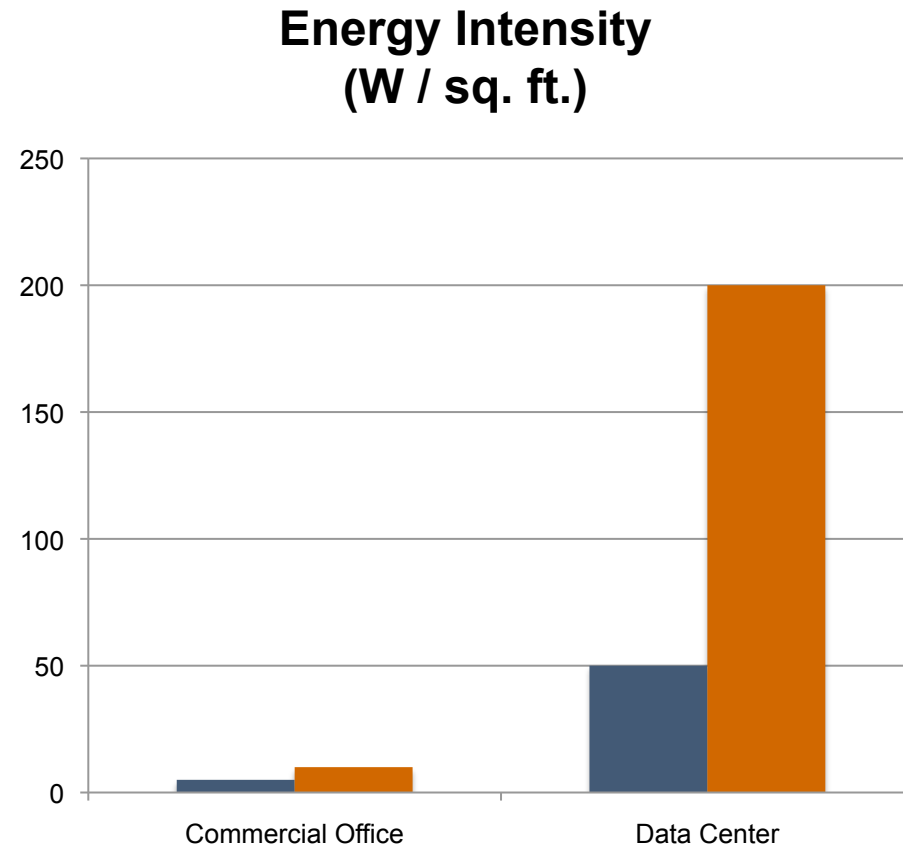
1. Source: Worldwide Electricity Used in Data Centers, J. Koomey 2008.
2. Presentation: *The New European Policy for Energy Efficiency in Data Centres: The Code of Conduct*. P. Bertoldi. 2009.

Why Focus on Data Centers?

Extremely Energy Dense!

➔ Up to 40X a typical commercial office building¹

➔ Opportunity for concentrated energy savings



1. Source: Best Practices for Data Centers: Lessons Learned from Benchmarking 22 Data Centers, Greenburg et al, 2006.

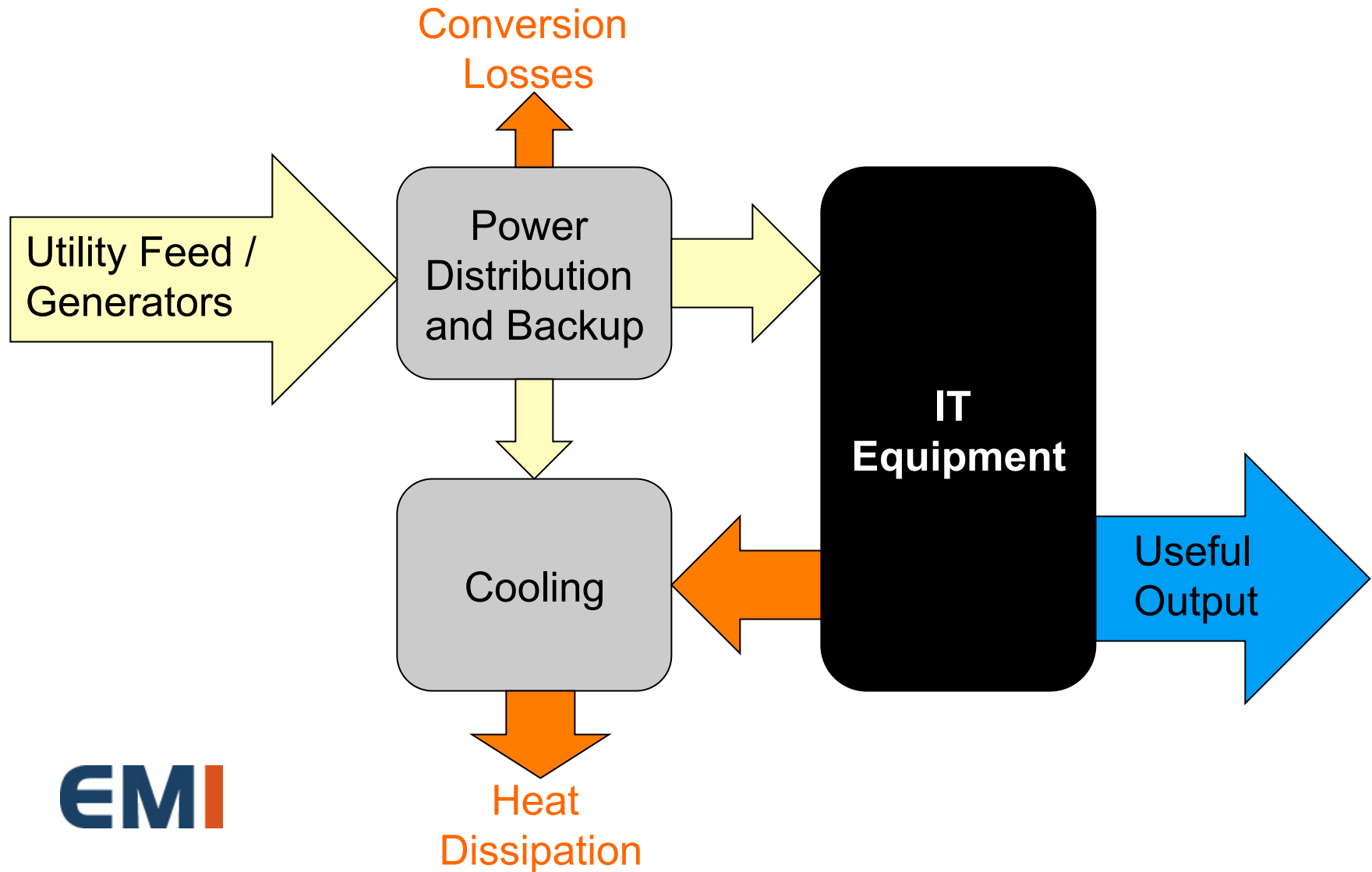
Size and Energy Use by Type

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%



Source: EPA Report to Congress on Server and Data Center Energy Efficiency, August 2, 2007

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

~ 50%

To IT Equipment:

- Servers
- Storage
- Networking

IT Equipment

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



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

Where Do Utilities Come In – Available Programs

Holistic Data Center			
<ul style="list-style-type: none">• Engineering Support / Technical Assistance• Efficiency Feasibility Studies or Energy Audits			
Cooling <ul style="list-style-type: none">• Chillers / HVAC / Economizers• Air Flow Management• Advanced Controls• VFDs	Power <ul style="list-style-type: none">• UPS• PDU• Transformers• Inverters	IT <ul style="list-style-type: none">• Efficient Servers• Efficient Power Supplies• Server Virtualization• Storage Virtualization (e.g., MAID)	Other <ul style="list-style-type: none">• Lighting• Efficient Computers• PC Power Management• Plug Load Management



What is the Target Market?

- Who qualifies?
- Where do you spend your marketing dollars?

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

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

A Special Challenge: Colocation Facilities

Growing faster than many industries

→ 15% annualized growth¹

Identified Barriers to Energy Efficiency

→ Aggravated split incentive

→ Pricing models

→ Focus on reliability

→ Reaching the colocation customers



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

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

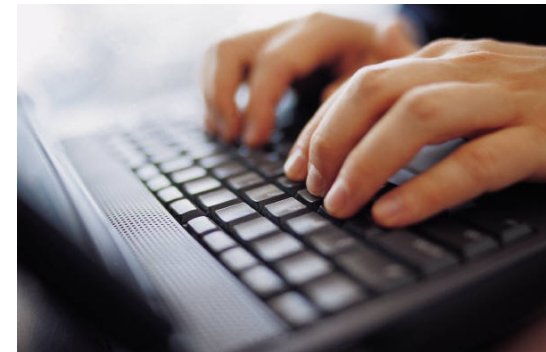
- <http://www.thegreengrid.org>

LBNL

- <http://hightech.lbl.gov>

Uptime Institute

- <http://www.uptimeinstitute.org/>



Contact

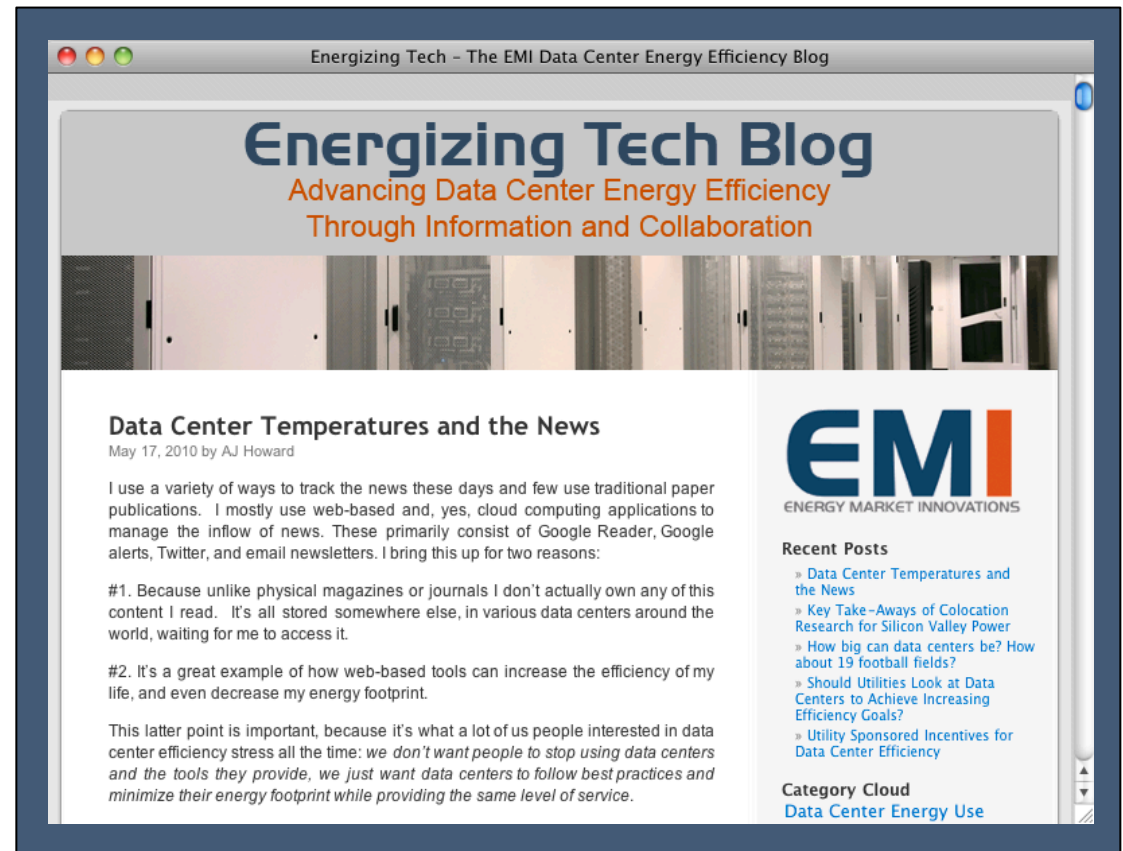
AJ Howard

EMI

ENERGY MARKET
INNOVATIONS

ajhoward@emi1.com

206.621.1160



The screenshot shows a web browser window titled "Energizing Tech - The EMI Data Center Energy Efficiency Blog". The main heading is "Energizing Tech Blog" with the subtitle "Advancing Data Center Energy Efficiency Through Information and Collaboration". Below the heading is a photograph of server racks in a data center. The main content area features a post titled "Data Center Temperatures and the News" by AJ Howard, dated May 17, 2010. The post discusses the author's use of web-based tools to track news and lists two reasons for this. A sidebar on the right contains the EMI logo, a "Recent Posts" section with five links, and a "Category Cloud" section with the link "Data Center Energy Use".

Energizing Tech - The EMI Data Center Energy Efficiency Blog

Energizing Tech Blog

Advancing Data Center Energy Efficiency
Through Information and Collaboration

Data Center Temperatures and the News

May 17, 2010 by AJ Howard

I use a variety of ways to track the news these days and few use traditional paper publications. I mostly use web-based and, yes, cloud computing applications to manage the inflow of news. These primarily consist of Google Reader, Google alerts, Twitter, and email newsletters. I bring this up for two reasons:

#1. Because unlike physical magazines or journals I don't actually own any of this content I read. It's all stored somewhere else, in various data centers around the world, waiting for me to access it.

#2. It's a great example of how web-based tools can increase the efficiency of my life, and even decrease my energy footprint.

This latter point is important, because it's what a lot of us people interested in data center efficiency stress all the time: *we don't want people to stop using data centers and the tools they provide, we just want data centers to follow best practices and minimize their energy footprint while providing the same level of service.*

EMI
ENERGY MARKET INNOVATIONS

Recent Posts

- » [Data Center Temperatures and the News](#)
- » [Key Take-Aways of Colocation Research for Silicon Valley Power](#)
- » [How big can data centers be? How about 19 football fields?](#)
- » [Should Utilities Look at Data Centers to Achieve Increasing Efficiency Goals?](#)
- » [Utility Sponsored Incentives for Data Center Efficiency](#)

Category Cloud

[Data Center Energy Use](#)

EMI

<http://datacenterblog.emi1.com/>