

Identifying Energy Saving Opportunities in the Data Center

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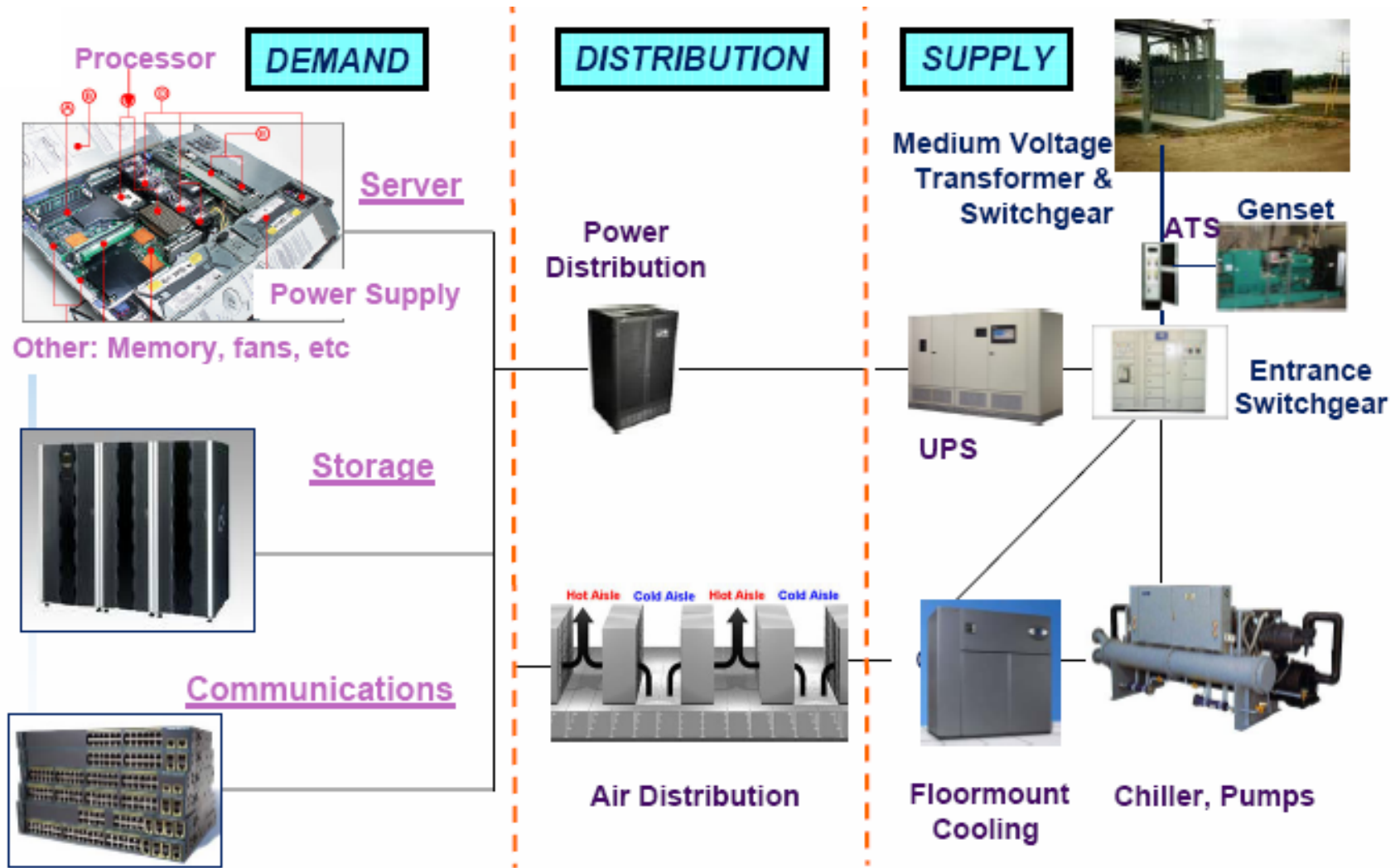
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Data Centers are INFORMATION FACTORIES

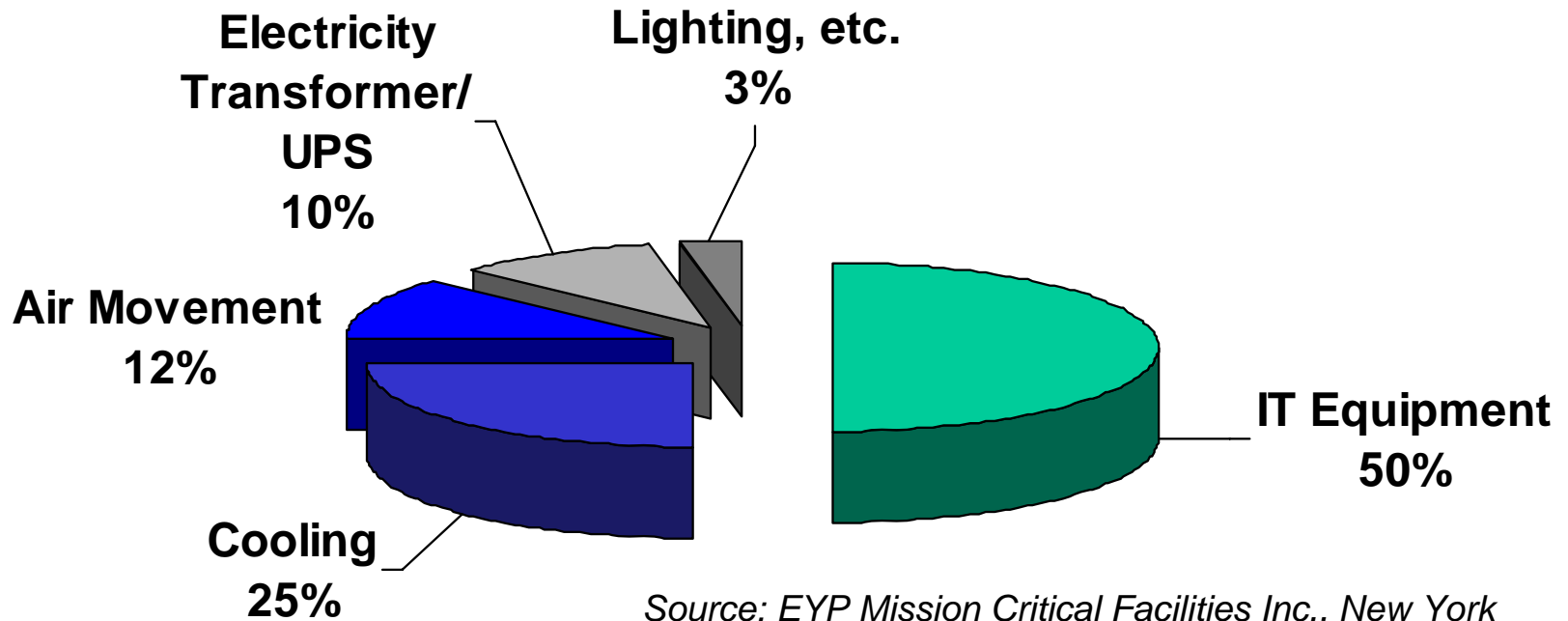


- Data centers are energy intensive facilities
 - Server racks now designed to carry 25 kW load
 - Surging demand for data storage
 - Typical facility ~ 1MW, can be > 20 MW
 - Nationally **1.5% of US Electricity consumption** in 2006
 - Could double in next 5 years
- New research by The Uptime Institute shows data center energy consumption in the top quartile of sites researched grew 20-30 percent annually in 2006 and 2007.
 - This far exceeds the EPA's prediction of 9 percent growth from 2006 to 2010

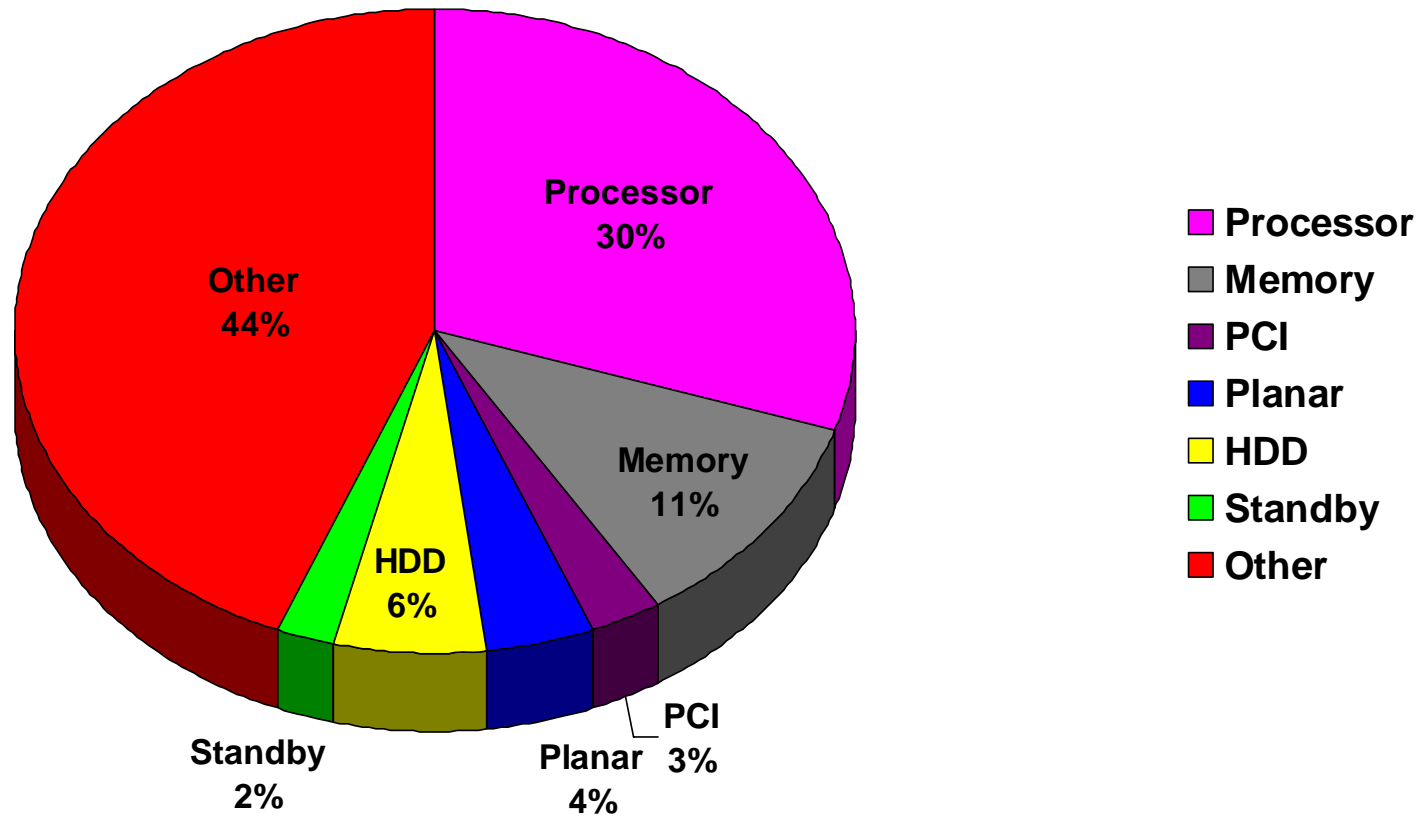
Simplified Data Center Layout



Where Data Center Power Goes



IT Equipment Power Distribution



Source: IBM, US EPA CSC Data Center Seminar, December 2007

The Rising Cost of Ownership



- From 2000 – 2006, computing performance increased 25x but energy efficiency only 8x
 - Amount of power consumed per \$1,000 of servers purchased has increased 4x
- Cost of electricity and supporting infrastructure now surpasses capital cost of IT equipment
- Perverse incentives -- IT and facilities costs separate

Market Challenges



Current Status

- No existing, widely accepted metrics for equipment or data centers re: energy performance
- Lack of consistent information available to the end user

Challenges

- IT technologies/applications rapidly changing
- Fears of unreliability with increased efficiencies
- Lack of communication between IT and facilities management

Industry Efforts



- **Green market** emerging aimed at reducing energy consumption in the data center
- Several industry led initiatives working to provide metrics, tools, and incentives to measure and/or reduce energy use:
 - Climate Savers Computing Initiative www.climatesaverscomputing.org
 - The Green Grid www.thegreengrid.com
 - The Uptime Institute www.uptimeinstitute.org
- Other industry groups getting involved:
 - Silicon Valley Leadership Group, Critical Facilities Roundtable, ASHRAE, AFCOM, others

What's the Government's Role?



- Federal agencies (EPA & DOE) can be catalyst
 - Stimulate competition on energy efficiency
 - Foster discussions between key stakeholders
 - Provide key recommendations (EPA Report to Congress)
 - Developing standardized test procedures and metrics to measure energy consumption (e.g., ENERGY STAR)
- Take the lead on best practices and metering federal datacenters
- Promote initiatives regionally (e.g., utilities) and globally (e.g., EU, China, Japan, Australia)

EPA National Computing Center RTP, NC

- 95,322 gross square feet, 46 Billion Btu/year
- LEED[®] silver certification in 2005
- Solar roof system and street lighting
- Energy efficient lighting in facility
- Building automation system, outside air economizers, variable speed HVAC systems
- **Energy audit conducted in February**
- For more information:

<http://www.epa.gov/rtp/facilities/virtualtour/ncc/index.htm>

Section 453 of the Energy Independence and Security Act

- Requires DOE and EPA to initiate a voluntary national data center energy efficiency information program
 - Incorporate activities from the DOE Industrial Technologies Program (i.e., Save Energy Now), DOE FEMP program, and EPA ENERGY STAR program
 - Close coordination with numerous industry stakeholders who are developing a variety of tools and informational resources to assist data center operators in their efforts to reduce energy use
 - More information: www.energystar.gov/datacenters

DOE Data Center Initiative



Save Energy Now Program Elements

- Develop DC Pro Software tool suite
- Create consensus metrics
- Develop and publicize case studies through pilot energy assessments
- Create best practices information and training curriculum
- Develop qualified specialists program for data centers
- Create guidelines for Best-In-Class data center

Key DOE Milestones



- **May 2008:** DC Pro tool beta release
- **May - September:** Training curriculum piloted
- **September 2008:** DC Pro tool version 1.0 release
- **December 2008:** Qualified Specialist training

• More information:

www1.eere.energy.gov/industry/saveenergynow/partnering_data_centers.html

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ENERGY STAR Rating for Data Center Infrastructure



- **Unit of Analysis:** IT Energy/Total Energy
- **What:** measure of infrastructure efficiency
 - Captures impact of cooling and support systems
 - Does not capture IT efficiency
- **Why:** Best available whole building measure
 - Important to start tracking, measuring, improving
 - Industry still developing ways to understand and measure IT output and efficiency
- **How:** Express ratio (IT/Total) as an ENERGY STAR 1-to-100 rating
 - Percentile of performance
 - Ratio value adjusted for: climate, tier level, other key factors

Key EPA Milestones



- **February:** Industry stakeholder meetings to discuss data collection needs
- **March:** Initiate data collection with data center operators
- **May 2009:** Conclude data collection
- **Summer/Fall 2009:** Review and analyze data and develop energy performance rating system
- **Fall 2009:** Share analytical results with industry
- **January 2010:** Launch data center infrastructure energy performance rating in Portfolio Manager; ENERGY STAR label available for stand-alone data centers

ENERGY STAR for Servers



- Key Elements of Draft 1 specification
 - Initial focus on volume servers, including blades if possible
 - Power supply efficiency/power factor
 - Standard reporting requirements
 - Power and temperature reporting requirements
 - Tier 2: Energy and computing performance metric TBD
- Other potential requirements
 - Idle power
 - Power management, virtualization

Key EPA Milestones



- **February 14:** Draft 1 specification released
 - Comments deadline March 14
- **April 2:** On-line stakeholder meeting
- **Mid/Late May:** Draft 2 specification released
- **Mid June:** In-person stakeholder meeting
- **June – November:** Additional drafts as needed
- **December:** Final specification published/effective
- More Information
 - www.energystar.gov/productdevelopment (click on New Specs in Development)

Shaping the Opportunity



- Data centers a key economic and CO2 reduction opportunity
- Few technology barriers to increased efficiency
 - Technologies available now to reduce consumption
- Few options to go “off the grid” or diversify supply
 - Data center operators looking for room to grow
- Good candidates for efficiency investments by utilities to reduce peak loads