

CEE Data Centers Workshop:

Informing Comprehensive Program Planning & Implementation

Jason Erwin, CEE
CEE Workshop
October 14, 2008



Figure 1 The National Energy Research Scientific Computing Center (NERSC) operated by LBNL

Today's Agenda

- Introduction
 - Overview of the opportunity and workshop objectives
- 11:45 – 1:00: Panel Presentations - Mapping Business Needs to Energy Efficiency Opportunities & Objectives
 - Jon Haas, Intel Corporation, The Green Grid
 - Anne Kraft, Xcel Energy
- *Lunch Break (1:00-1:45pm)*
- 1:45 – 5:00: Collaborative Planning - Putting Together the Program Pieces

Data Center Energy Picture

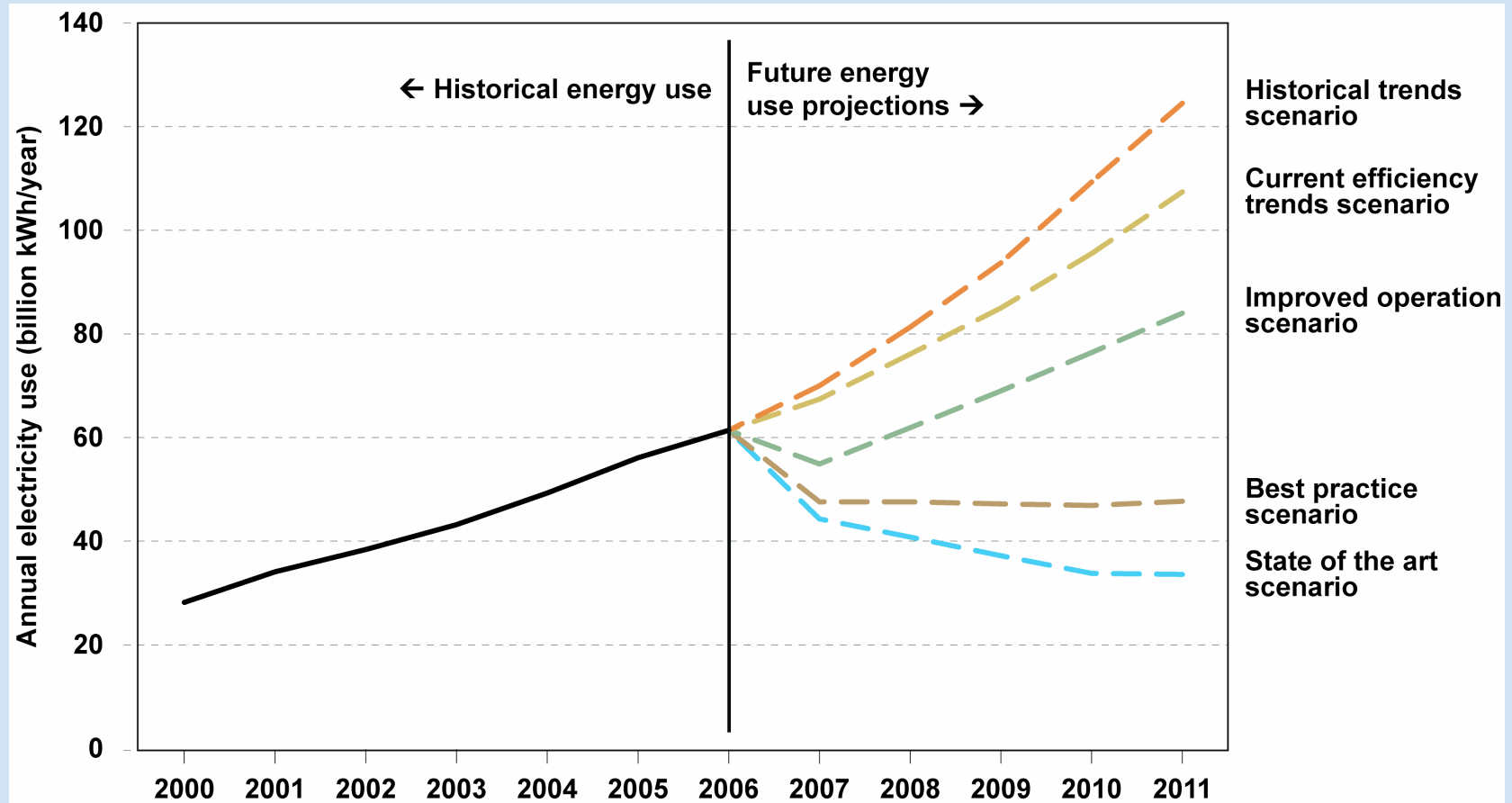
- Data centers are energy intensive facilities
 - Server racks now designed to carry 25 kW load
 - Typical facility ~ 1MW, can be > 20 MW
 - Nationally 1.5% of U.S. Electricity consumption in 2006, growing
- Recent research shows DC energy consumption growing 20-30% annually in 2006 and 2007
 - Exceeds EPA's prediction of 9% growth from 2006 to 2010
 - Surging demand for data storage

Sources: EPA Report to Congress (2007); Uptime Institute growth estimate (2008)



Working Together, Advancing Efficiency

Data Center Energy Trends



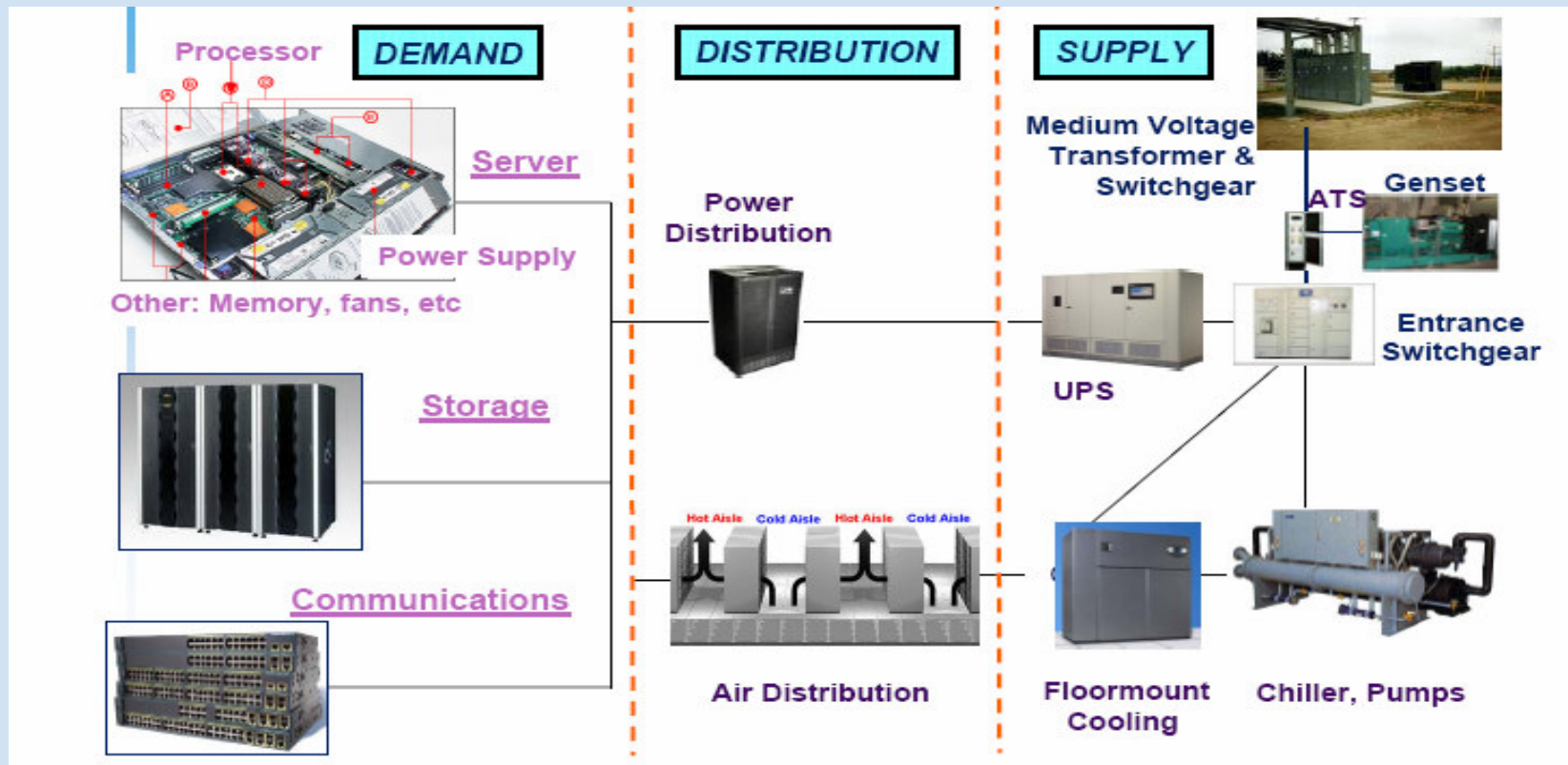
Source: EPA Report to Congress (2007)

Data Center – Where Energy Goes

IT: 30-50%

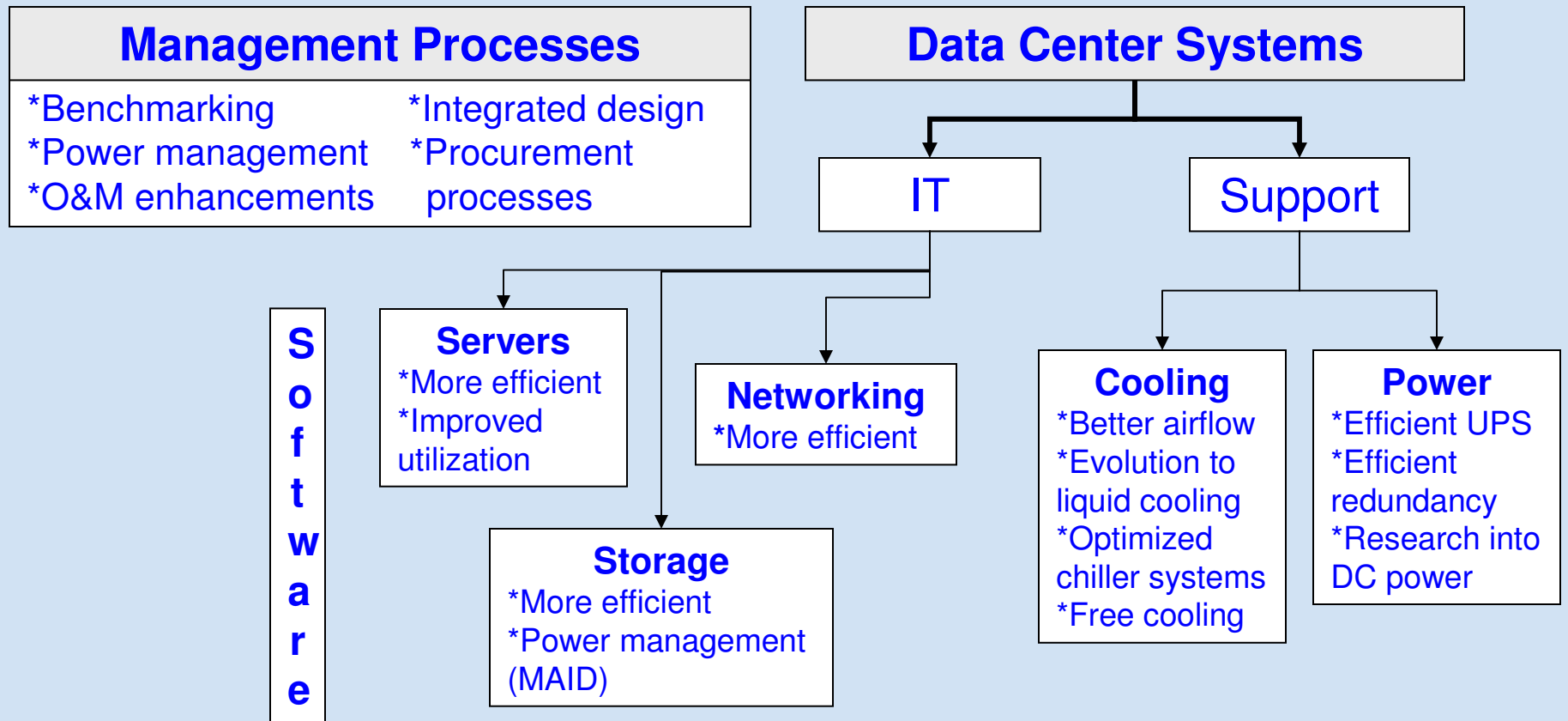
Cooling: 25-30%

E. Distribution: 25-30%



Source: Emerson Network Power, Data Center Users Group 2007

Data Center EE Opportunities



Data Center EE Opportunities

| Scenario | Explanation | 2007-2011 Energy Cons. (billion kWh/yr) | % Savings from CET |
|---------------------------|--|---|--------------------|
| Historic trends | Extrapolates observed 2000 to 2006 energy-use trends. Doubling of e-use from 2000-06. | 478.8 | N/A |
| Current efficiency trends | Projects the energy use based on recently observed efficiency trends. | 431.4 | 0% |
| Improved operations | "Low-hanging fruit" - little capital investment. E.g., Eliminate unused servers; turn on power management; Improve air flow management. | 346.3 | 20% |
| "Best" practice | Increased adoption of the practices/technologies used in most EE facilities today. Moderate consolidation of servers/storage; improved efficiency for power/cooling; free cooling. | 236.9 | 45% |
| State-of-the-Art | Using most EE technologies and practices available today. E.g., Aggressive consolidation of servers/storage; direct liquid cooling; CHP. | 189.7 | 56% |

Data Source: EPA 2007 Data Center EE Report

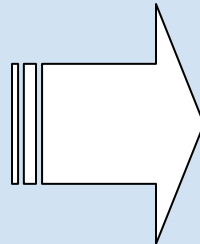


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CEE Data Centers Initiative

Challenges

- Lack of efficiency definitions and need for consistent metrics and test procedures
- Lack of consistent info for the end users
- Split incentives between IT & facility managers
- Risk aversion and barriers to EE acceptance – reliability and uptime concerns trump others
- Dynamic nature of software and hardware operations



CEE Initiative Objectives

- Developing & supporting consensus-based definitions and performance specs
- Facilitating our collective understanding of opportunity, market players & industry motivations
- Identifying recommended program strategies to help move more of the market to a preferred outcome

CEE Member Programs

| EE Program Tracking | Data Center Program Offerings |
|---------------------|---|
| Austin Energy | *Financial incentives for IT and other measures (e.g., MAID, server virtualization, efficient UPSs, chillers/cooling) |
| BC Hydro | *Qualifies IT consultants to perform customer data center screening and assessments, with focus on virtualization of IT equipment (servers). Potential financial incentives for virtualization and other capital measures |
| Energy Trust OR | *Pilot project providing technical assistance on more efficient enterprise data center design |
| Oncor Electric | *Pilot program, offering data center baseline energy use analysis and potential financial and technical incentives for server virtualization and infrastructure measures |
| PG&E | *Financial incentives for various IT and facilities energy savings measures (e.g., server virtualization, MAID, cooling) *Design assistance for new construction (Savings by Design) |
| SCE, SDG&E | *Offer virtualization and other DC incentives through SPC; *Design assistance (Savings by Design) |



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Workshop Objectives

- To understand business perspectives on data center energy use and IT industry data center efficiency initiatives
- Identify mutual objectives, efforts and needs in order to define and prioritize our work going forward

Panel Presentations

- Mapping Business Needs to Energy Efficiency Opportunities & Objectives
 - Jon Haas, Intel Corporation & Board Member, The Green Grid
 - Anne Kraft, Xcel Energy

Part 2: Collaborative Planning Agenda

- 1:45 – 2:25 Status of data centers work area, group brainstorming, prioritization
- 2:25 – 3:00 Small group breakouts and discussion
- *3:00 – 3:30 Break*
- 3:30 – 4:10 Small group reporting
- 4:10 – 5:00 Discussion, refinement and wrap up

Workshop Objectives

- To understand business perspectives on data center energy use and IT industry data center efficiency initiatives
- Identify mutual objectives, efforts and needs in order to define and prioritize our work going forward

Part 2: Collaborative Planning

1. Test hypothesis: There is not one dominant basis to organize the data center program opportunity.
2. If hypothesis = true, then

“In order for me to justify and develop/evolve a data centers program, here are the necessary and sufficient conditions I need to be in place: _____???”

Part 2: Collaborative Planning

Dominant basis for organizing data center opportunity??

| Program Dimensions | Fundamental Questions |
|---------------------------------|---|
| Customer engagement | How do we organize customers? Is there a dominant basis that will serve program needs? |
| Metrics, benchmarks & baselines | What metrics do we use and why? How do we establish performance benchmarks and consumption baselines? |
| Offerings | What added value can EE programs provide? What offerings are valued (technical, financial, informational) across customer types? |
| Evaluation | How do we evaluate programs, given the complexity? What additional information do we need (e.g., rate of uptake of EE practices, technologies, customer risks)? |

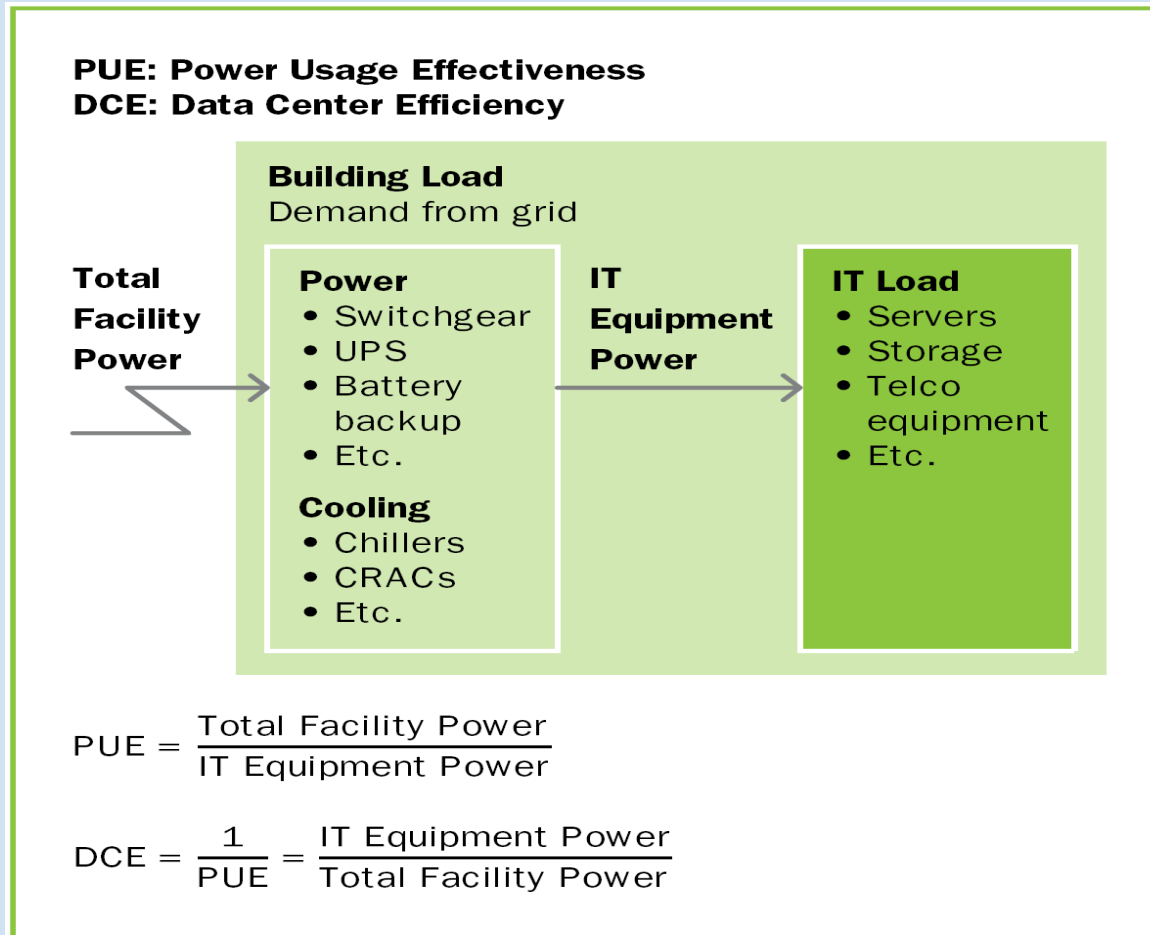
Part 2: Collaborative Planning

- Collective Needs and Direction
 - What is the added value EE programs bring to data centers customers in the short run? What information is valuable to gather centrally to inform program development? E.g., early program experiences, pilots, RFP concept for qualified contractors
 - What are our strategic needs in the future? What relevant activities are underway - information is being collected? What don't we know that would help inform more comprehensive program development?
 - What are the gaps and holes that CEE can fill, short term and longer term?



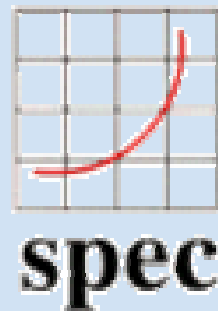
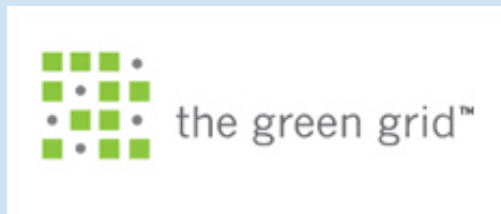
Appendix – Extra Material

E.g., DC Energy Metrics



Source: A description of power usage factors and the PUE calculation from The Green Grid.

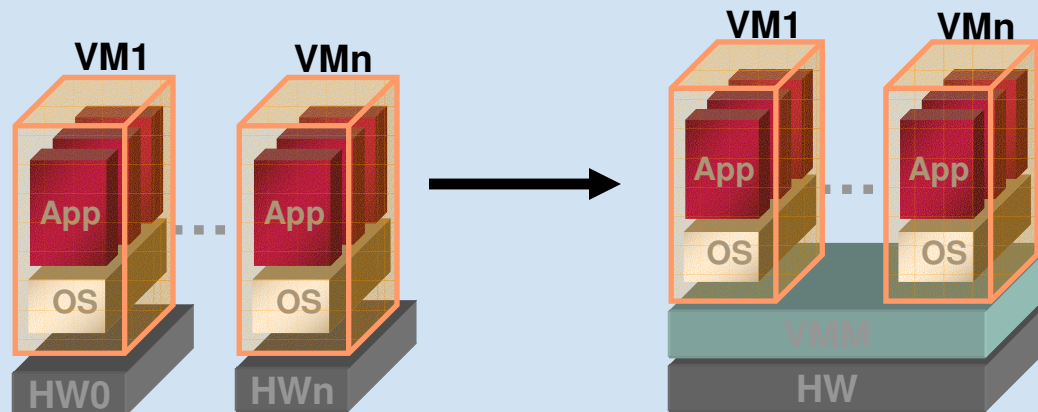
National & Local DC Activities



Data Center Energy Efficiency Opportunities

E.g., Server Virtualization

- Consolidates multiple workloads onto one physical server (3-1; 5-1; 7-1; 30-1 and more depending on application)
- More businesses moving towards virtual environments
- Large potential for energy savings depending on application



Sources: Intel Corporation (Graphic); VMWare, IDC (Content)

CEE Activities



Broad Activities:

- Support active Data Centers and Servers Members Committee
 - Over 25 utility and other efficiency program administrators participating
- Building knowledge of IT industry and opportunities to work together
- Active participation in EPA and DOE programs
- Developing and supporting local program strategies to help customers arrive at optimal solutions

Government DC Activities

U.S. DOE and EPA initiating a voluntary national DC energy efficiency information program

- DOE Industrial Technologies Program, DOE FEMP program, and EPA ENERGY STAR program
- Close coordination with numerous industry stakeholders, developing tools and informational resources to assist data center operators reduce energy use

U.S. DOE - Activities

- 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

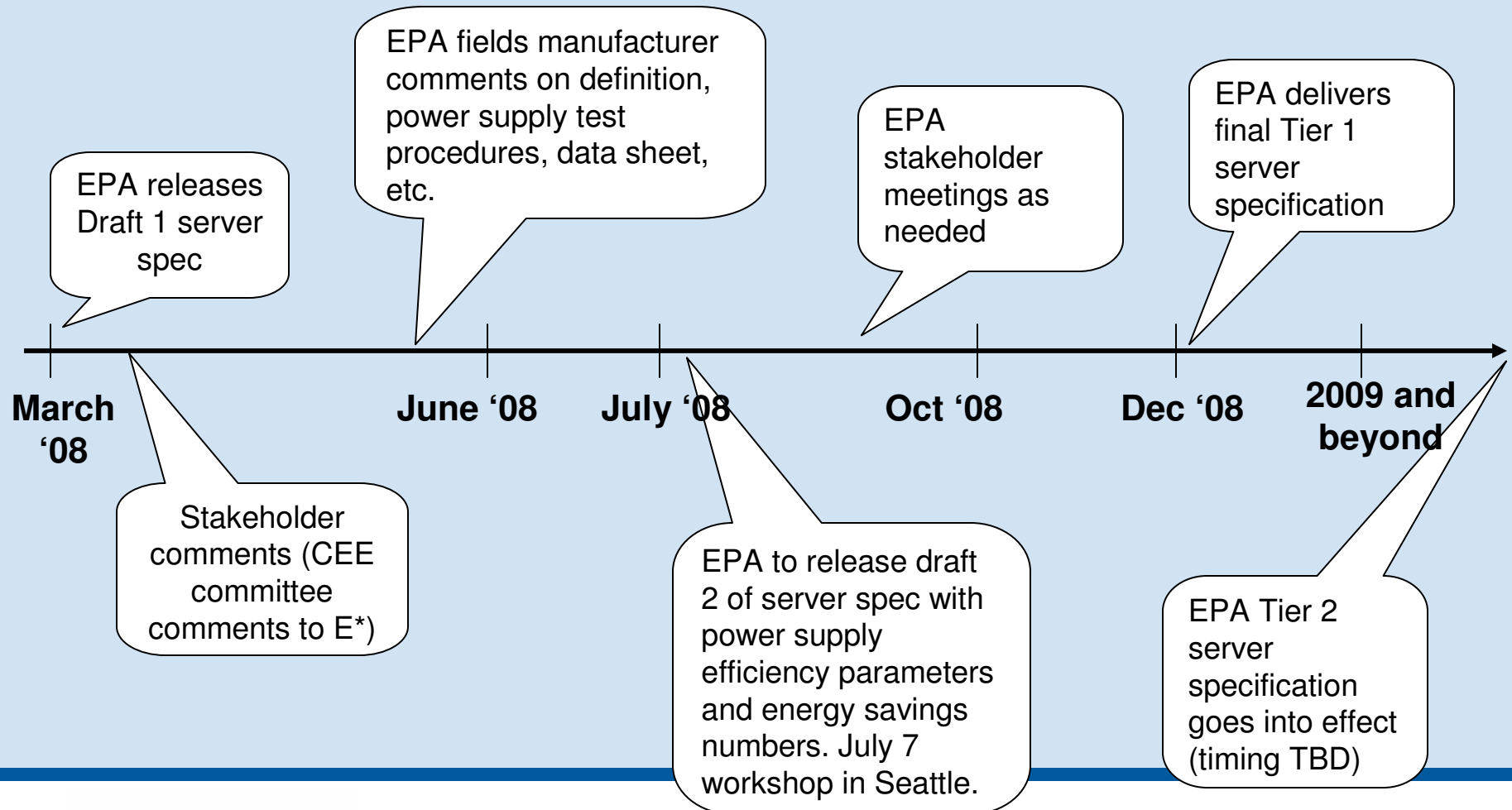
U.S. DOE - Timeline

- **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:**
 - Paul Scheihing, DOE: Paul.Scheihing@ee.doe.gov
 - Bill Tschudi, LBNL: WFTschudi@lbl.gov

EPA - Activities

- **Benchmark Unit of Analysis: IT Energy/Total Energy**
 - Measure infrastructure efficiency
 - Captures impact of cooling and support systems
 - Does not capture IT efficiency
 - Best available whole-building measure
 - Important to start tracking, measuring, improving
 - Industry still developing ways to understand and measure IT output and efficiency
 - 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
- **Server Performance Specification**

EPA - Timeline



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