

# LBL High-tech Buildings Energy Efficiency Activities



August 14, 2007

Dale Sartor & Bill Tschudi

# LBL High-tech Building Sponsors

- California Energy Commission – PIER program
- Pacific Gas and Electric Company
- New York State Energy and Development Agency (NYSERDA)
- US - Environmental Protection Agency
- US – Department of Energy
- Northwest Energy Efficiency Alliance
- Universities

# Data Center research activities

- Research Roadmap
- Benchmarking, case studies, best practices
- Self-benchmarking protocol
- Power supply efficiency study
- UPS systems efficiency study
- Standby generation losses
- Performance metrics – Computation/watt
- Market study
- EPA report to Congress

# Cleanroom research activities

- Research Roadmap
- Benchmarking, case studies, best practices
- Standby generation losses
- Fan-filter and mini-environment studies
- Demand controlled filtration
- Market study
- Training/outreach

# Laboratory Energy Efficiency Activities

- Laboratories for the 21<sup>st</sup> Century (LABS 21)
- Low flow fume hood development
- Benchmarking and case studies
- Training/outreach

## Next Phase California Projects (Public Interest Energy Research)

- Develop LEED type criteria for data centers
- Evaluate modular and scalable cooling solutions
- Promote use of air side economizers
  - study filtration
  - failure research and failure data collection
  - collaborate with ASHRAE
- Demonstrate spray cool technology
- Continue DC power initiative

## Next phase California projects

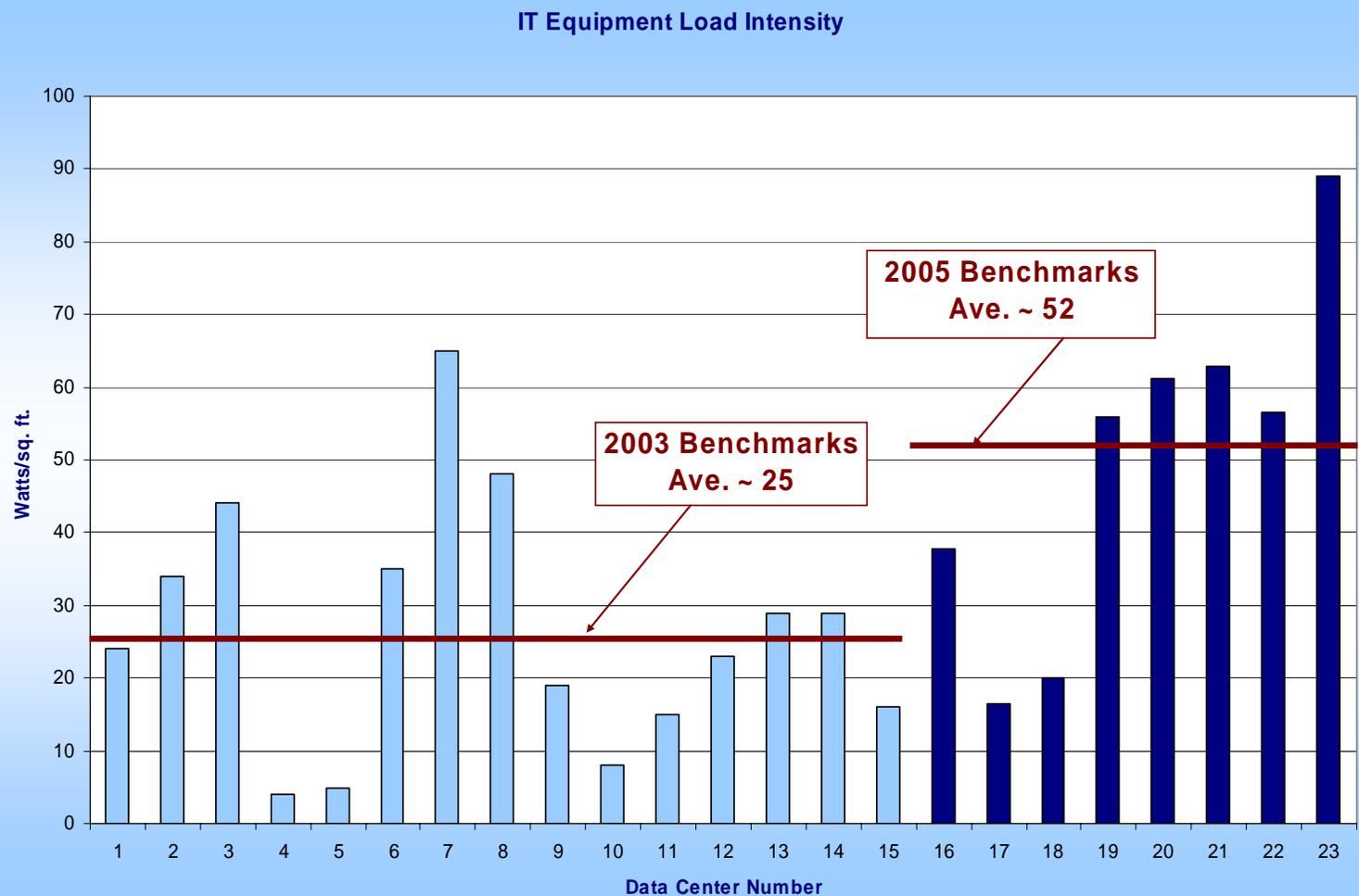
- Develop LEED type criteria for cleanrooms
- Case Studies
- Investigate heat recovery options
- Investigate process efficiency opportunities

# Next phase California projects

Investigate cross-cutting issues:

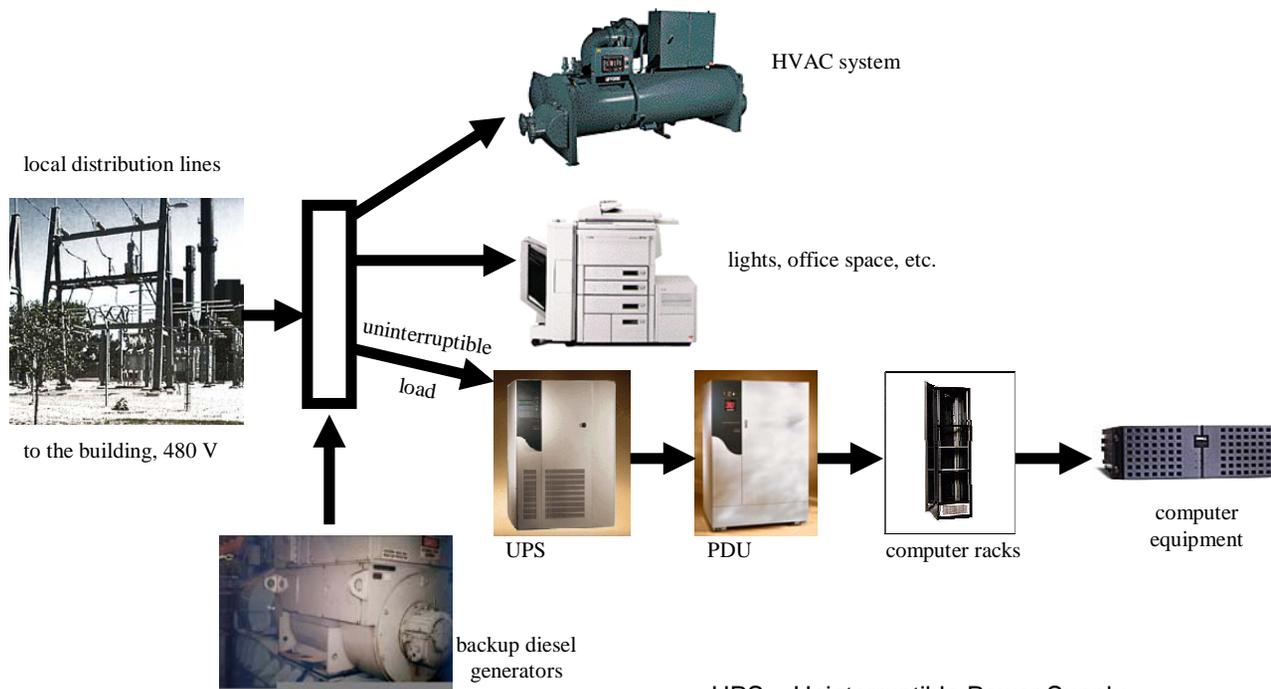
- Low pressure drop design
- Document best practices
- Commissioning strategies

# IT equipment load density



# Benchmarking energy end use

## Electricity Flows in Data Centers

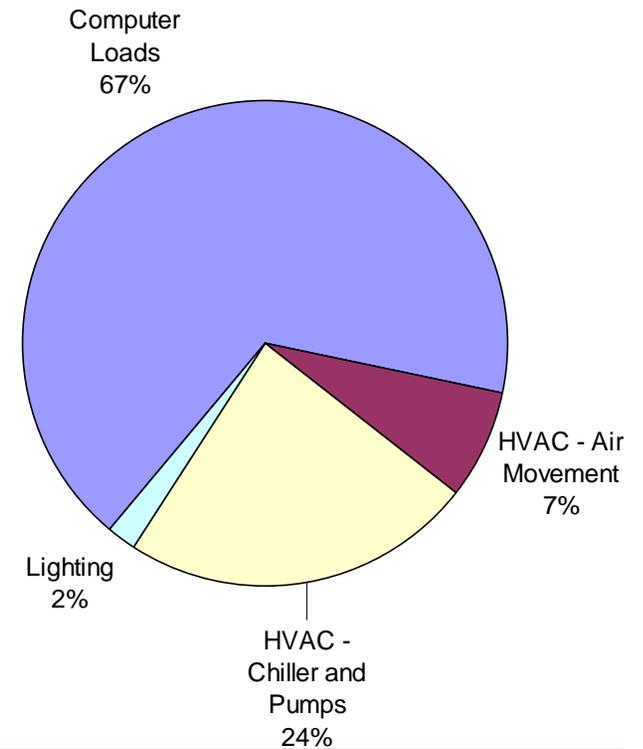
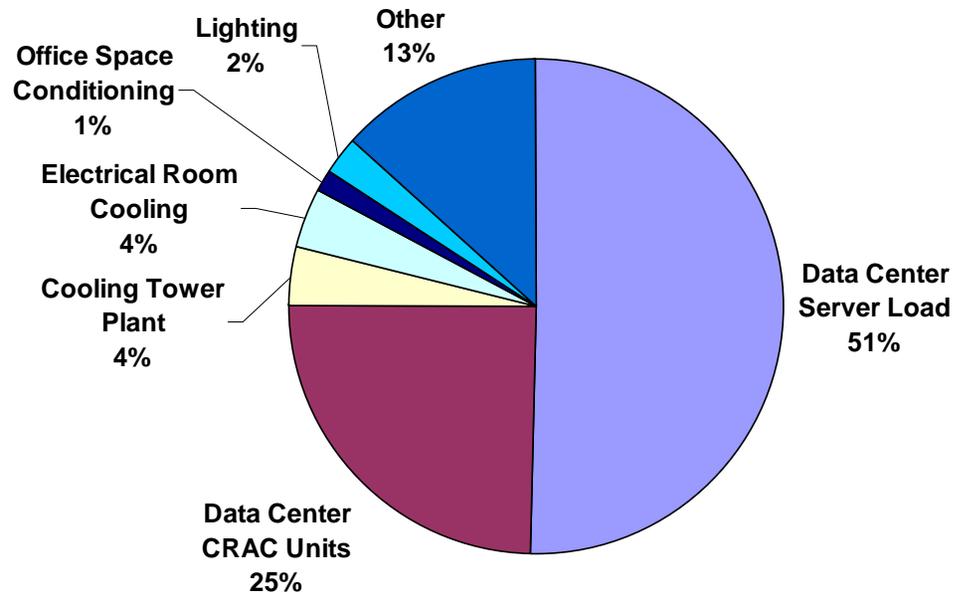


UPS = Uninterruptible Power Supply

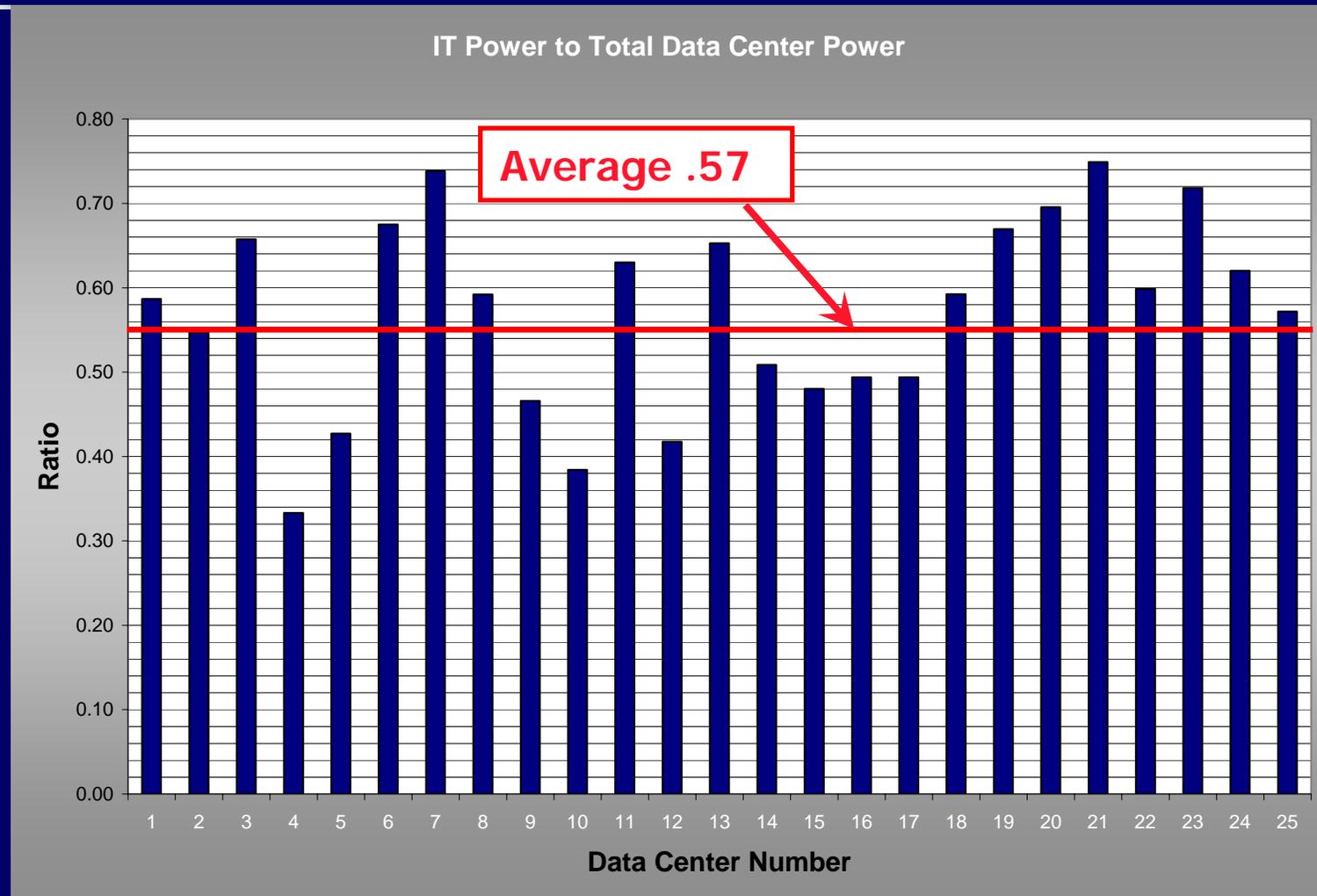
PDU = Power Distribution Unit;

# Performance varies

The relative percentages of the energy actually doing computing varied considerably.

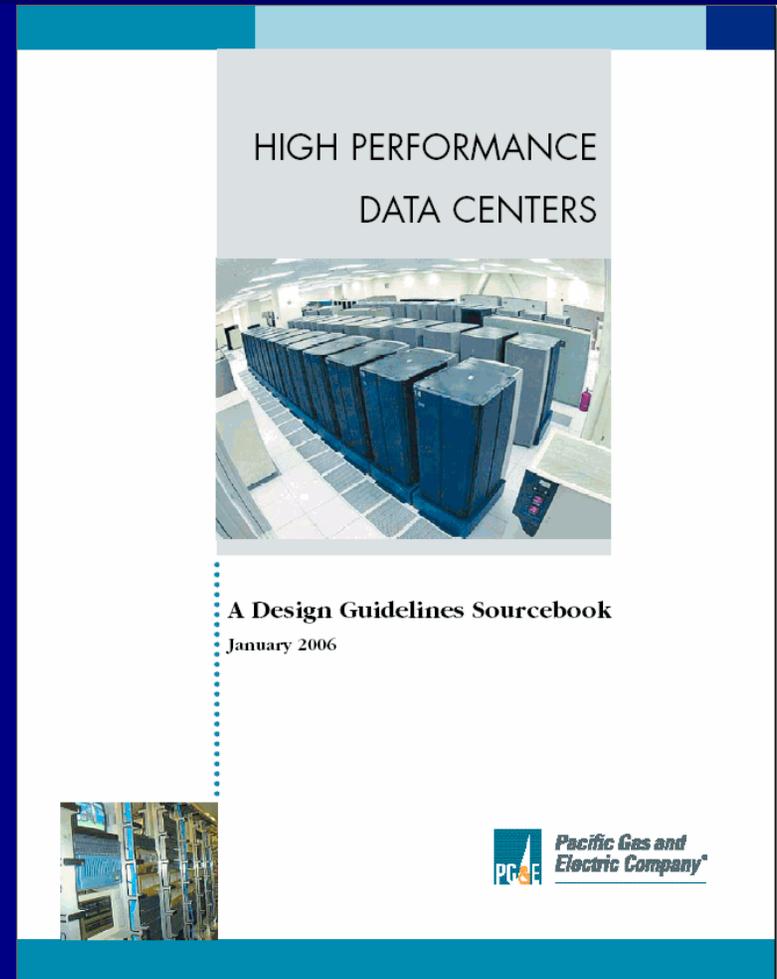


# Percentage of power delivered to IT equipment



# Design guidelines were developed in collaboration with PG&E

Guides available through  
PG&E's Energy Design  
Resources Website



# Design guidance is summarized in a web based training resource

The screenshot shows a web browser window titled "Data Center Energy Management - Mozilla Firefox". The address bar displays "http://hightech.lbl.gov/dctraining/TOP.html". The website header includes "DATA CENTER ENERGY MANAGEMENT" and a navigation menu with links: About, Benchmarking, Best Practices Checklist, Design Intent Documentation, Economics, Non-energy Benefits, Case Studies, Tools, and Emerging Technologies.

On the left side, there is a sidebar with the following text:  
■ This website will give you the tools and information to capture cost-effective savings opportunities to the design of new data centers or to retrofit existing ones.  
Presentations  
Chart Room  
Resources  
Exercises  
Credits  
LAWRENCE BERKELEY NATIONAL LABORATORY

The main content area features a vertical bar on the left labeled "ft<sup>2</sup>/yr" with a scale from \$5 (Low) to \$75 (High). To the right of this bar is a "Get Started:" section with a form:  
Get Started:  
Enter your annual energy cost  
 \$/yr  
and data center size  
 sq ft

Below the form is a 3D rendering of a data center aisle with blue server racks and blue arrows indicating airflow. Below the rendering is the text: "Range of Energy Costs in Real Data Centers".

At the bottom of the page, it states: "For public sector and private sector users." and lists the contributing organizations: High-Tech Research, Applications Team, Environmental Energy Technologies Division, and Berkeley Lab.

<http://hightech.lbl.gov/dctraining/TOP.html>

# LBNL Data Center demonstration projects

- Outside air economizer demonstration (PG&E)
  - Contamination concerns
  - Humidity control concerns
- DC powering demonstrations (CEC-PIER)
  - Facility level
  - Rack level
- “Air management” demonstration (PG&E)

**website: <http://hightech.lbl.gov/>**