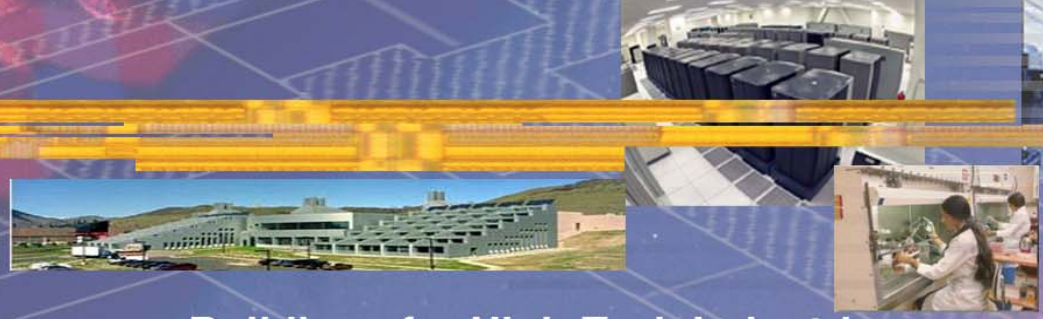


High-Performance Buildings for High-Tech Industries

Data Center Energy Research and Demonstrations

Critical Facilities Roundtable Meeting - March 25, 2005

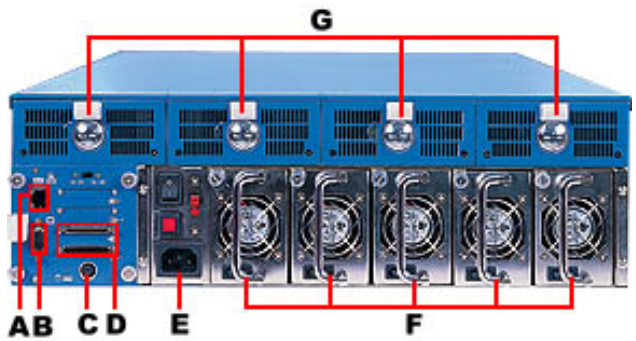
Bill Tschudi
Lawrence Berkeley National Laboratory

http://hightech.lbl.gov

Public Interest Energy Research (PIER)
California Institute for Energy & Environment (CIEE)

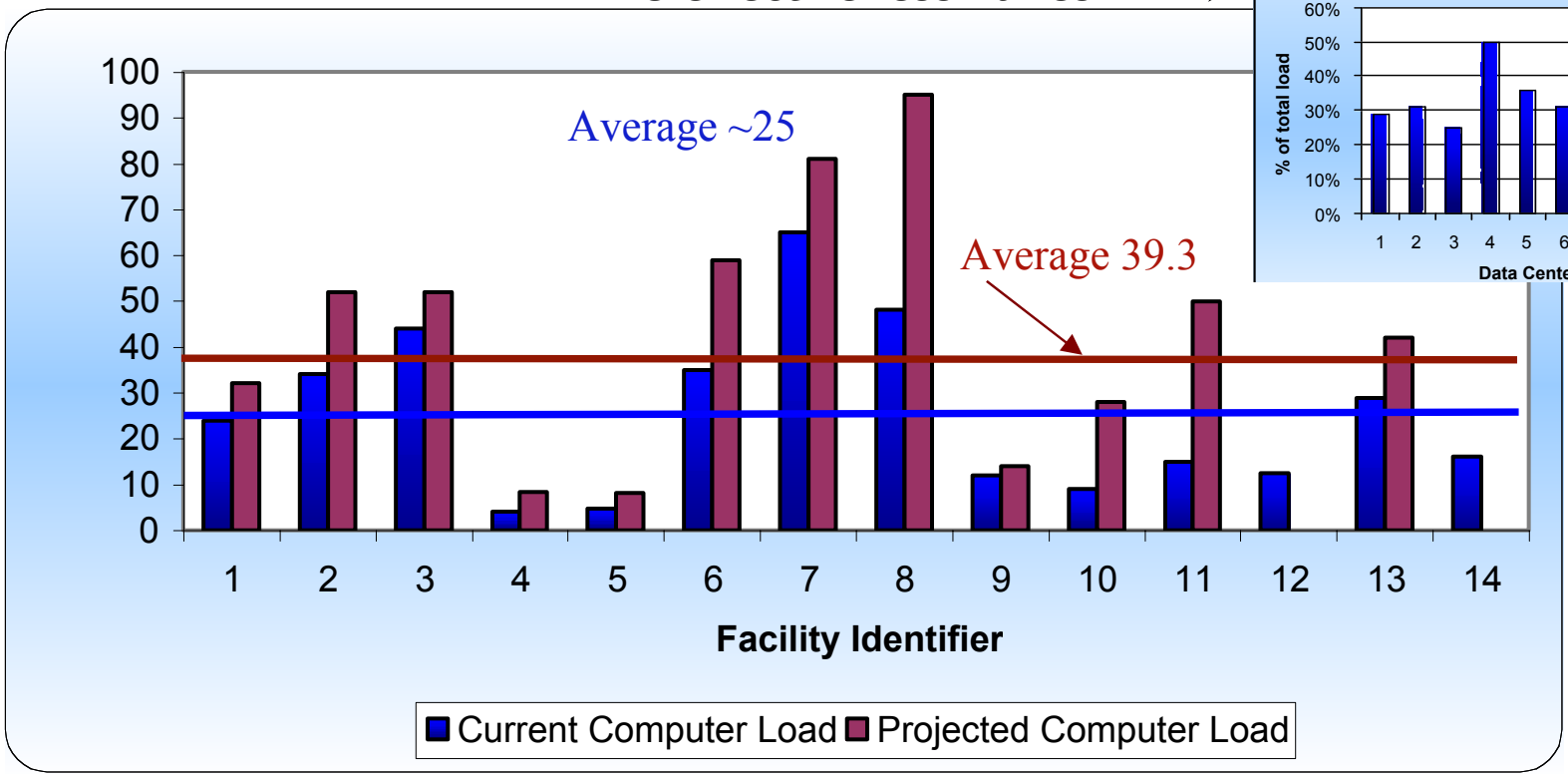
Current LBNL data center related activities

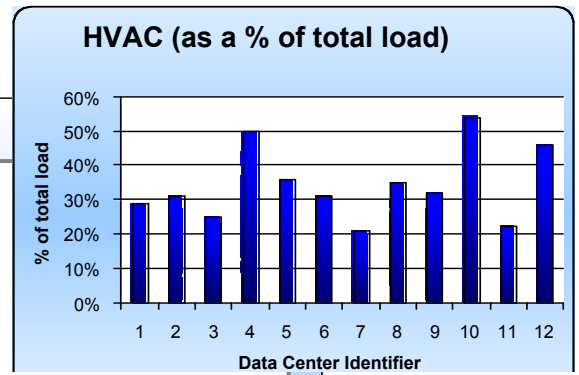
- Benchmarking and Best Practices identification
  - Research-directed benchmarking
  - Self-benchmarking protocol
- Improve uninterruptible power supplies (UPS)
- Develop performance metrics (Computing vs. Watts)
- Improve power supplies in IT equipment
- Adding demonstration projects



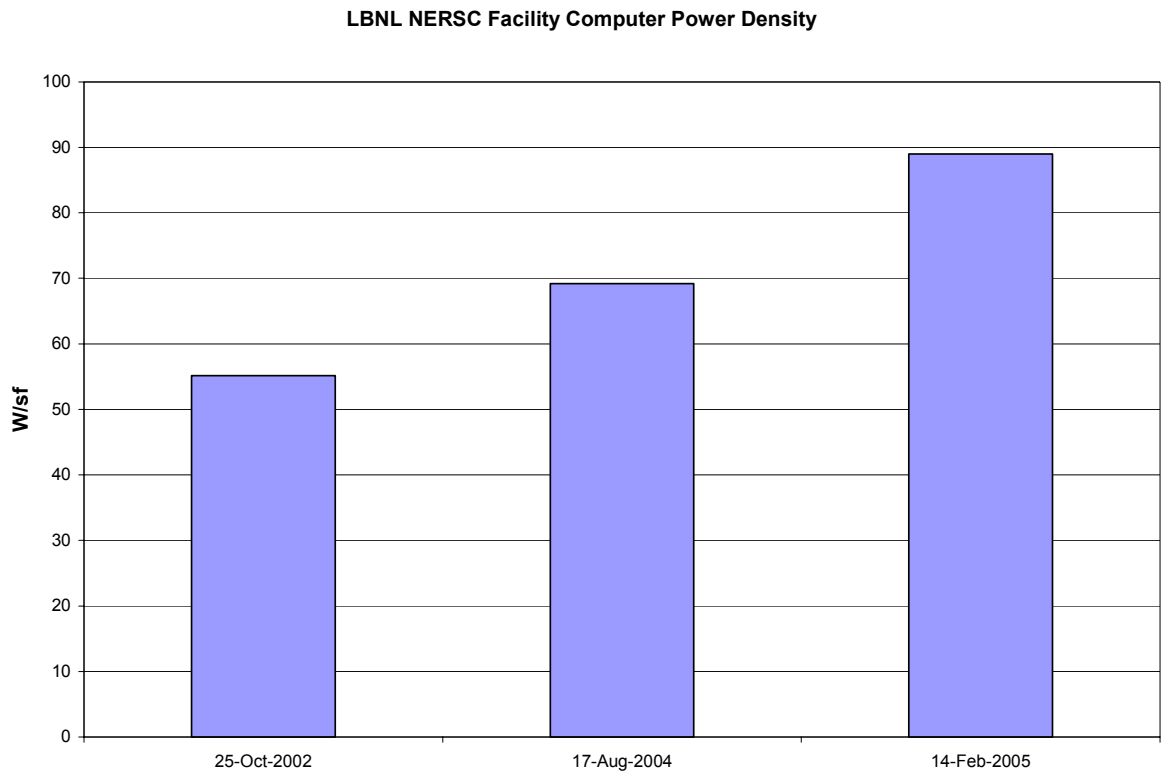
Wide range of efficiencies:
For example: data center HVAC

HVAC effectiveness varies →

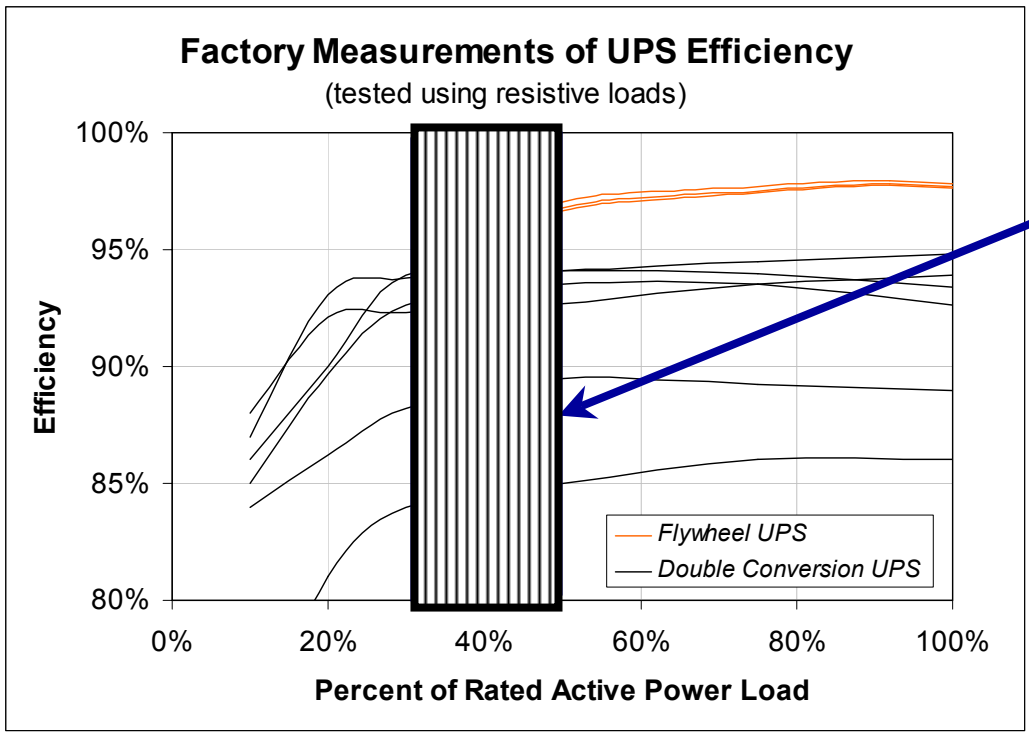




Load intensity is increasing in our supercomputing center



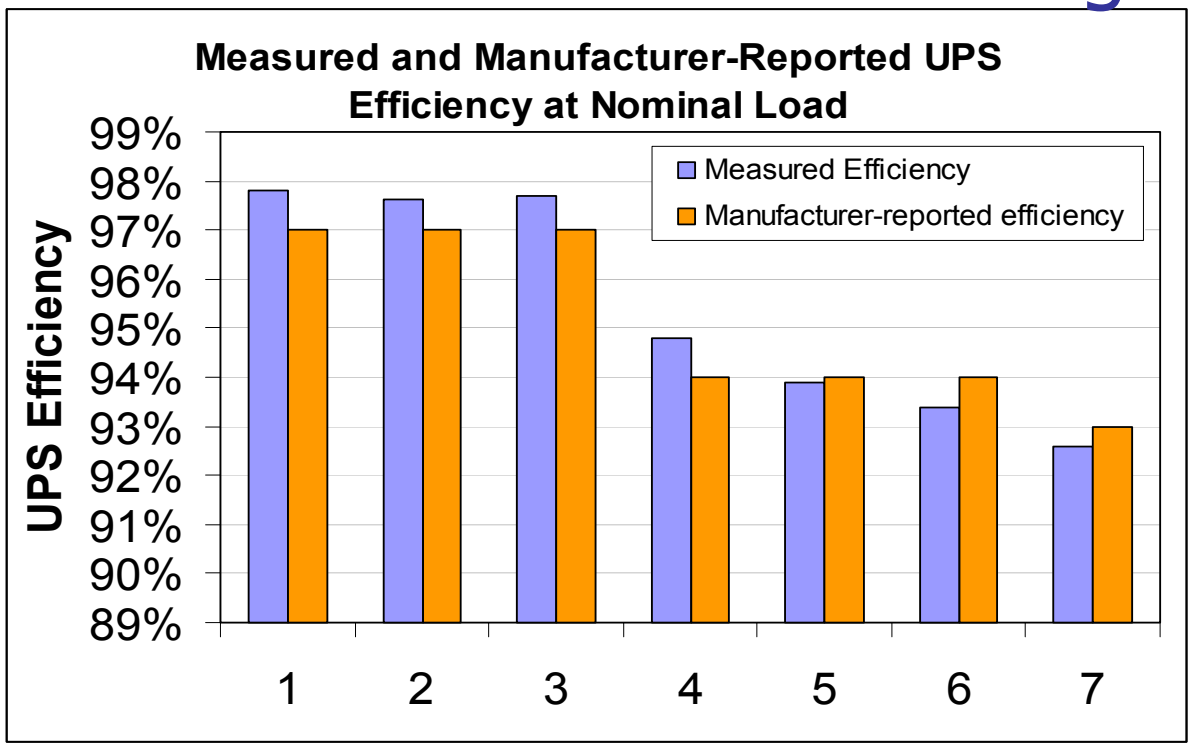
Measured UPS Efficiency



Typical operating range

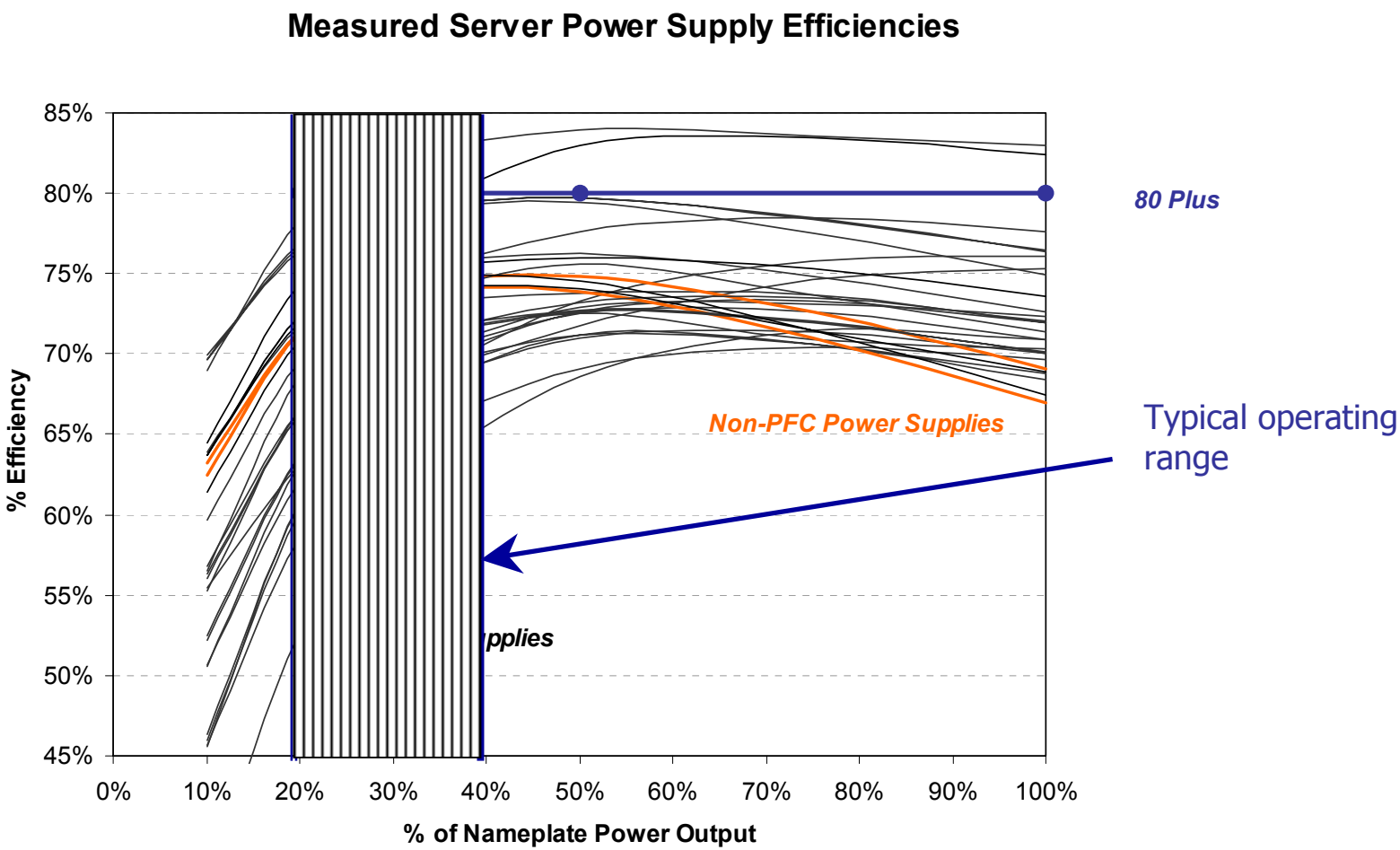
Efficiency ranged from 86% to 97% at peak load, but efficiency under typical operating loads ranges from 81% to 97%

Data Centers – UPS measured vs mfg. efficiency



- Manufacturer's reported efficiency in product literature consistently within 1% of measured performance
- Unfortunately, manufacturers often do not report efficiency in typical data center operating range (30% - 50%)

Power Supply Findings:



Power Conversion Conclusions:

- There is a wide range of efficiency for both UPS and power supplies and they have lower part load efficiency (where most operate)
- Server power supplies are less efficient than PC's
- Computer manufacturers caution that setting criteria for power supplies may lead to "gaming" of the rest of the power supply chain
- Elimination of electric power conversion(s) could be a large impact on energy use

Data center demonstration projects

- Heat removal from servers without fans
- DC powering rack of computers
- IT/facilities design process for new supercomputer center
  -

Heat removal without fans demonstration

- Start-up company – Nisvara has patented technology using carbon micro fiber to efficiently conduct heat in one direction to a point where it can be transferred to air or liquid.
- Seeking "industry partner(s)" to provide servers and rack systems to modify to use this technology. Also seeking a demonstration site.

Heat removal without fans …

- Discussions with server manufacturers, processor and other component manufacturers
- www.nisvara.com

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DC powering demonstration

- Demonstrate energy savings using commercially available DC power at rack level to eliminate or consolidate a power conversion
- Various potential configurations and manufacturers
- Seeking "industry partner(s)" to provide servers to modify to use this technology. Also may involve a demonstration site.
- Potential overlap with heat removal demo

Thank you

Contact me if you would like to participate

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