

# **Data Center Electricity Use: What We Know**

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# Introduction

- Much confusion about data center electricity use (see Mitchell-Jackson et al., 2002 and 2003)
- Review recent data from
  - Koomey study (released 15 Feb 07)
  - LBNL Benchmarking
  - Uptime facilities
- Discuss efficiency opportunities

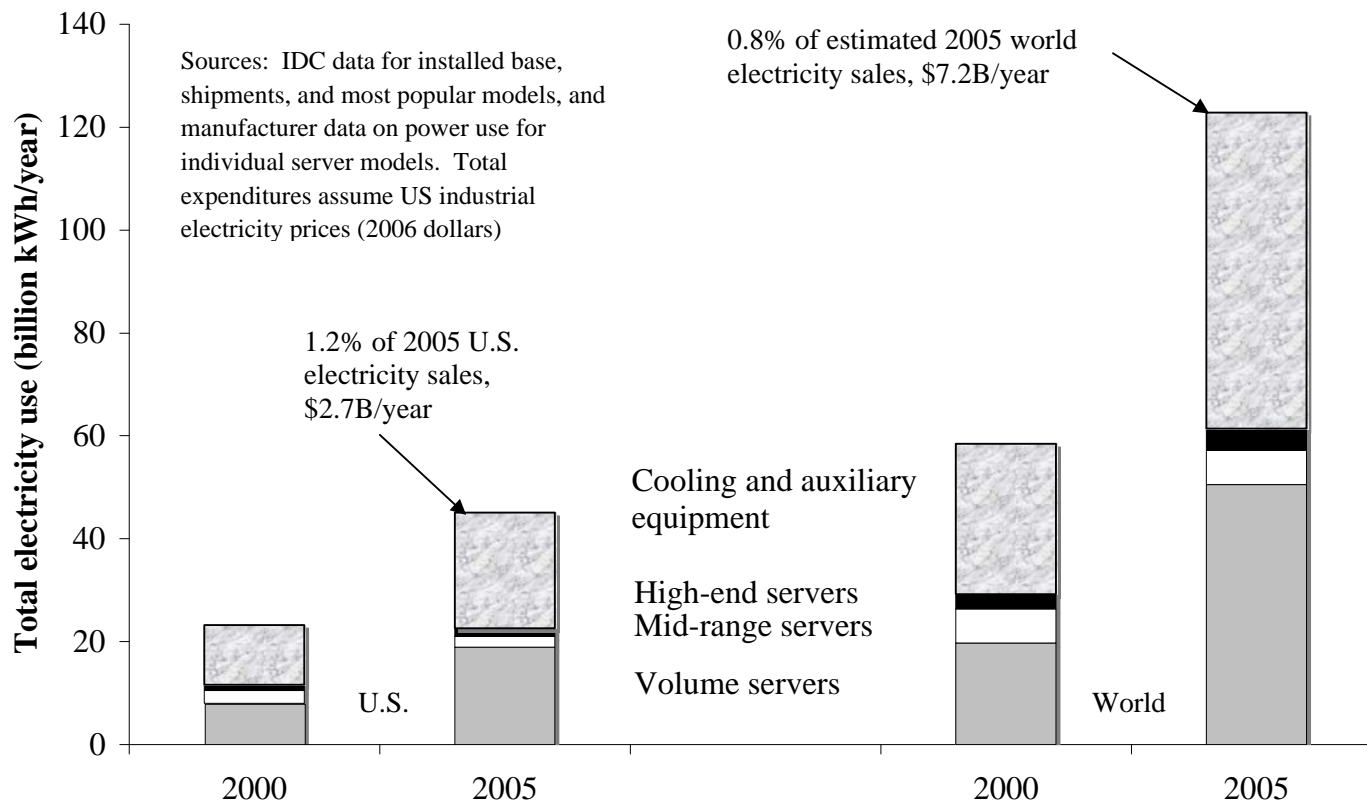
# New study on server power

- Details
  - Hot off the presses! (15 February 2007)
  - Funded by AMD
  - Authored by Jonathan Koomey
- Download it at  
<http://enterprise.amd.com/us-en/AMD-Business/Technology-Home/Power-Management.aspx>
- Reviewers from all major industry players

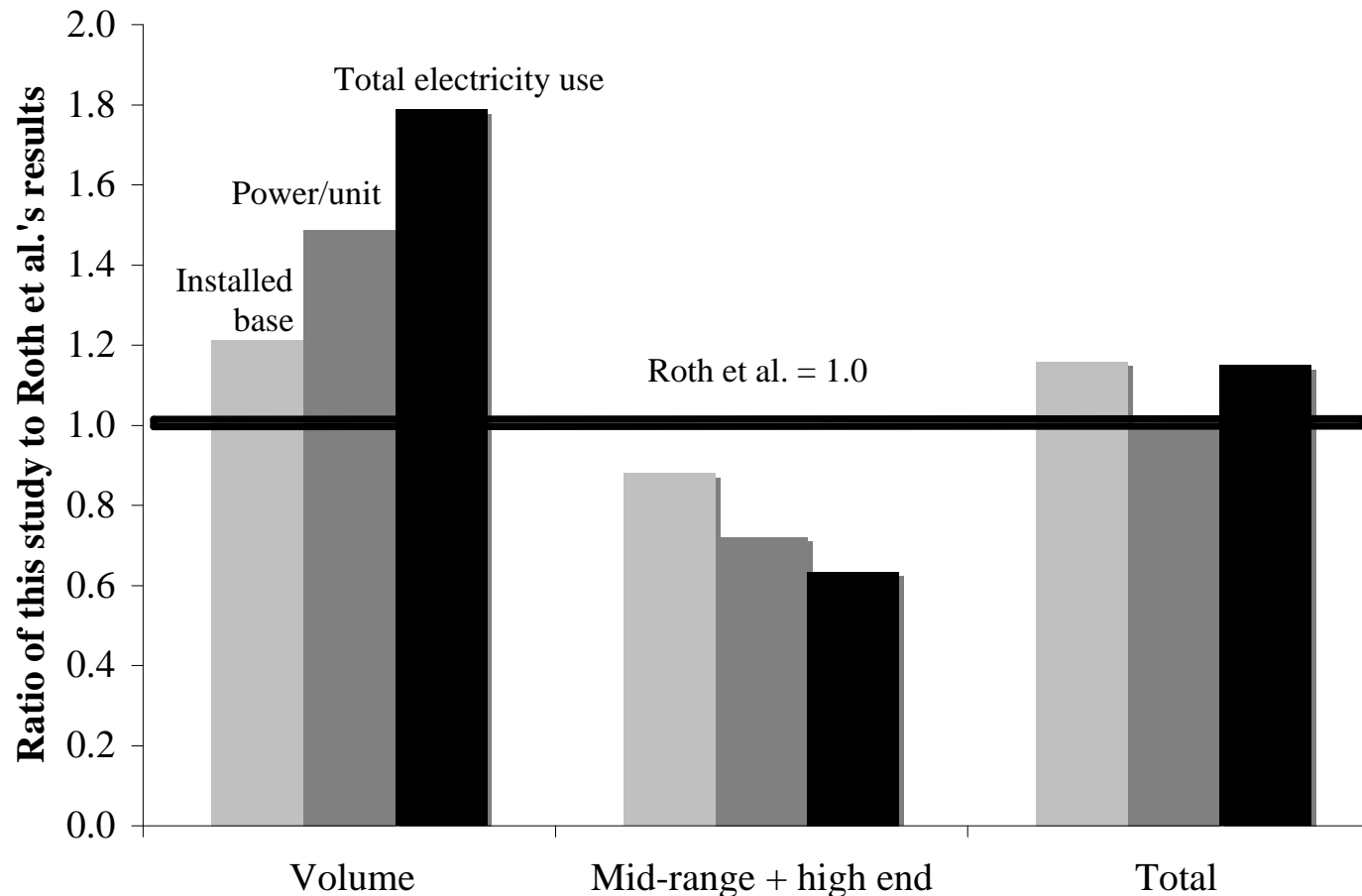
# New server power study methods and data

- Estimated power use for servers
  - 2000 and 2005
  - Volume, mid-range, and high end servers
  - U.S. and World
- Used IDC data for total installed base and most popular models
- Used manufacturer data/estimates for typical power used per unit

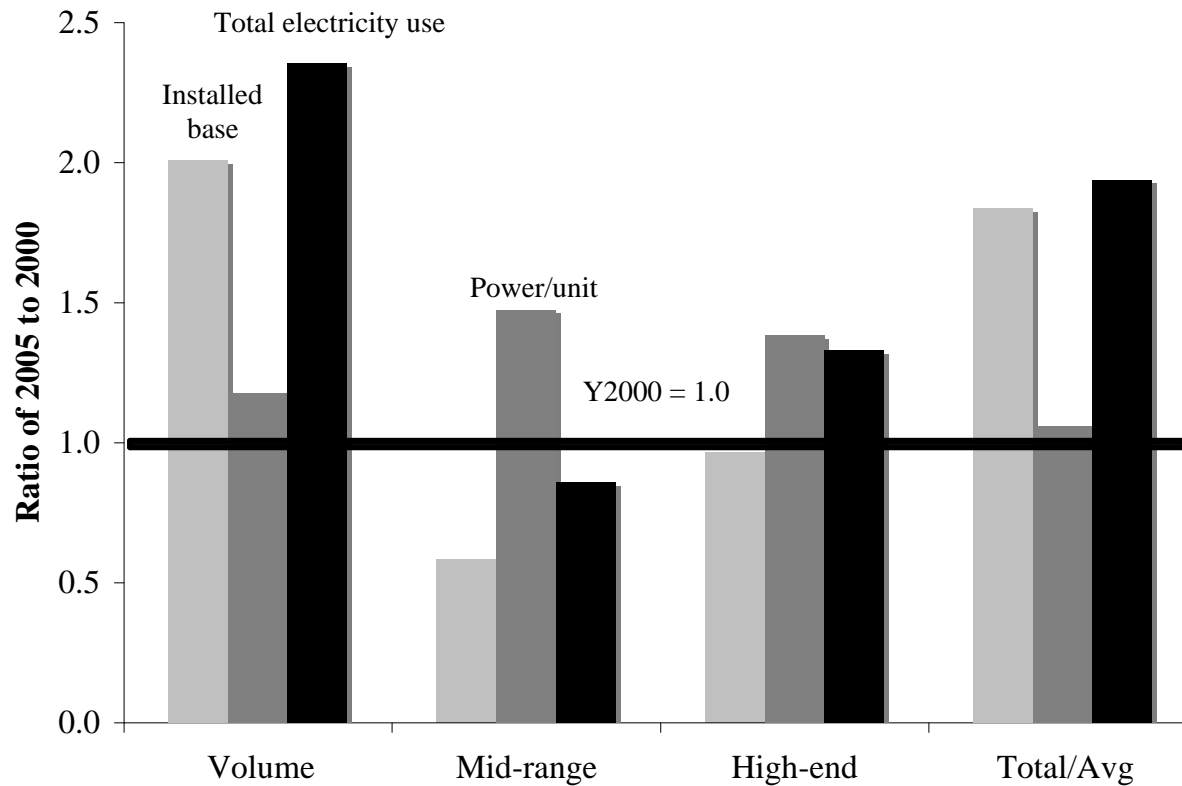
# Summary results for server electricity use



# Comparing my estimates for 2000 to those of Roth et al.



# Comparing 2005 to 2000 for U.S. servers

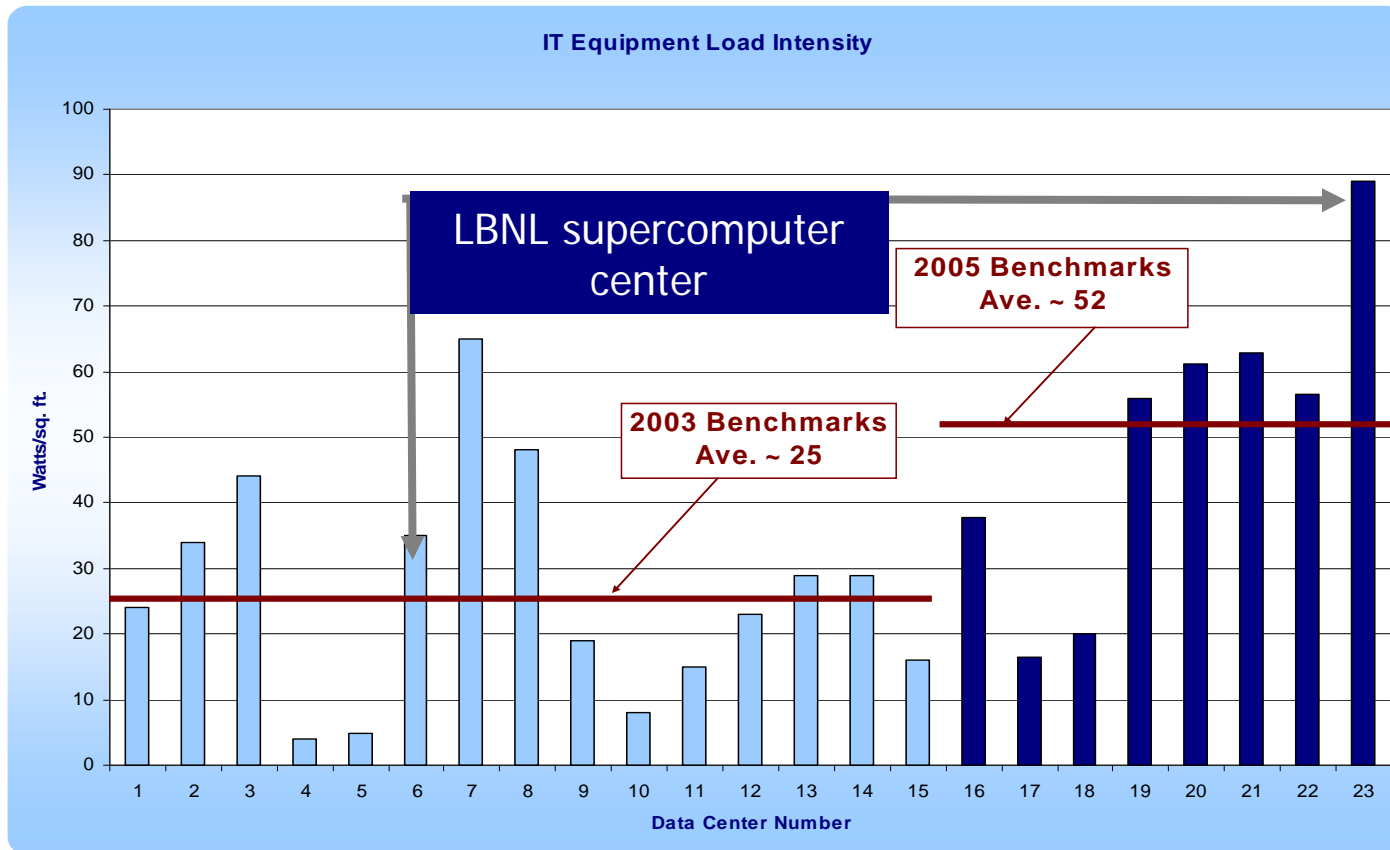


# LBNL case studies

- 22 Data centers in California and New York
- Detailed metering and analysis of facilities
- Led by Bill Tschudi and Dale Sartor of LBNL, in collaboration with Steve Greenberg and Evan Mills of LBNL, Peter Rumsey of Rumsey Engineers, and Bruce Myatt of EYP Mission Critical Facilities.



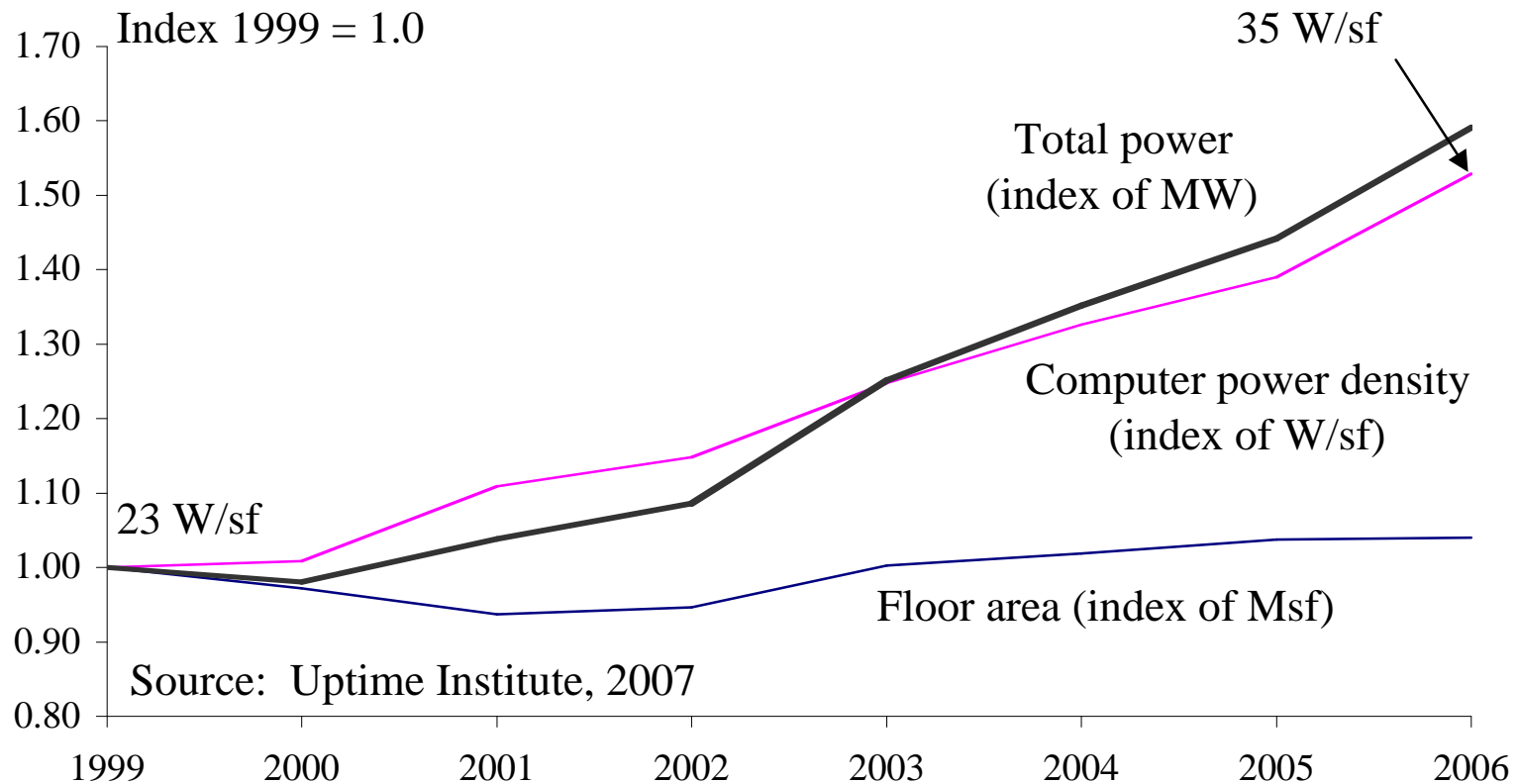
# LBNL benchmarking results: Computer power densities



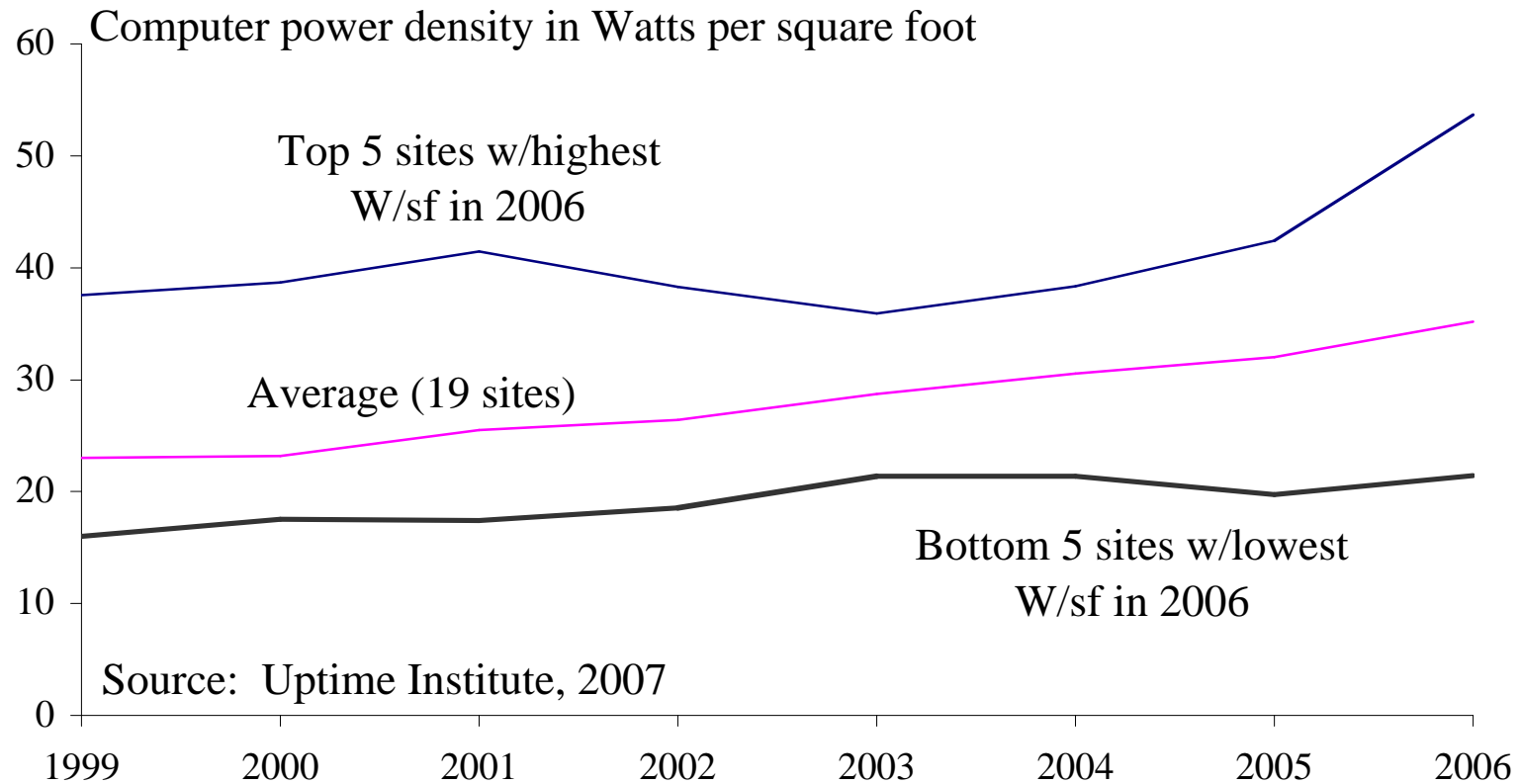
# Uptime Institute data

- The Site Uptime Network is a technical membership organization for data center operators and designers
- Uptime has tracked 19 data centers for 8 years
  - Total IT load, floor area, and computer power densities (W/sf)

# Trends in 19 Site Uptime Network facilities



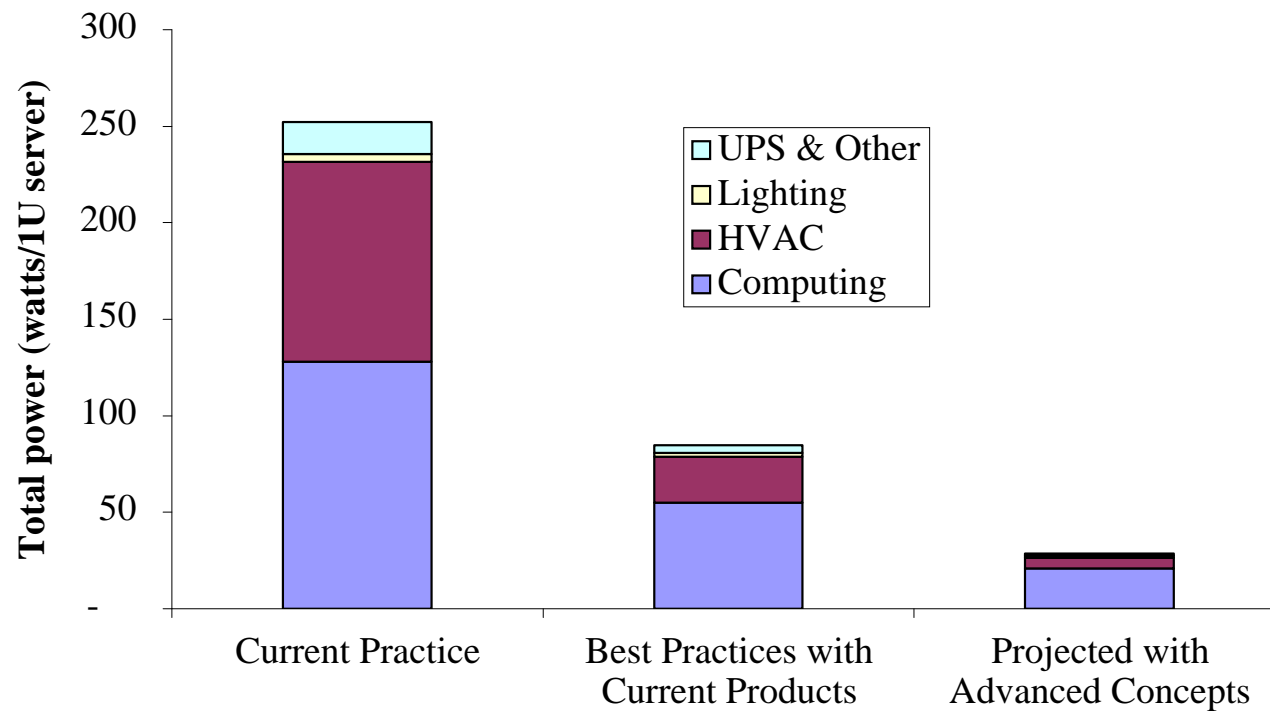
# More on Uptime's 19 facilities



# Efficiency opportunities abound

- Think “whole system redesign”
- Align incentives to minimize Total Cost of Ownership (TCO)
- Low hanging fruit (Uptime, Ecos, LBNL)
  - Modify current infrastructure + operations
  - Kill dead servers
  - Buy efficient power supplies
- A little more work
  - Metrics for servers tied to purchases
  - Metrics for infrastructure efficiency
  - Virtualization & consolidation

# Efficiency opportunities: RMI Charrette results (Feb 2003)



For details, see <http://www.rmi.org/sitepages/pid626.php>

# Conclusions

- Total data center power
  - is about 1.2% of U.S. electricity use (including cooling and auxiliaries)
  - roughly doubled from 2000 to 2005
- If IDC installed base forecast to 2010 holds, server power use up another 40% to 76% from 2005
- W/sf appears to be going up
- Lots of efficiency opportunities!