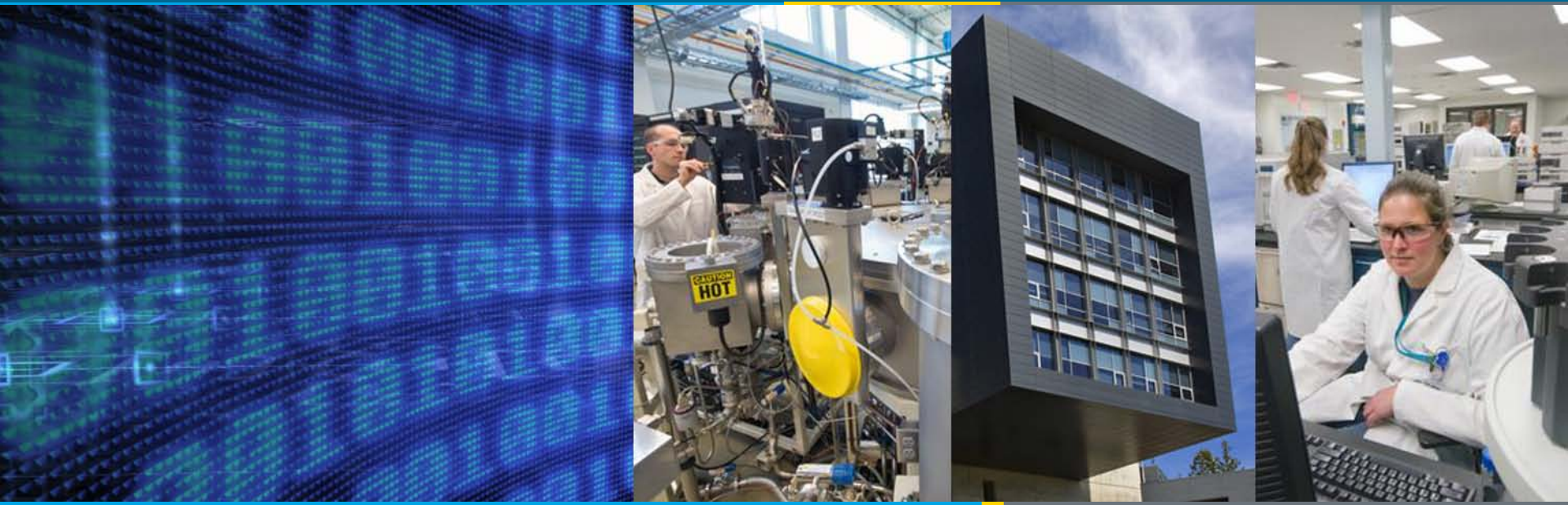
# Federal Energy Management Program

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy




## Labs, Data Centers, and High Tech Facilities

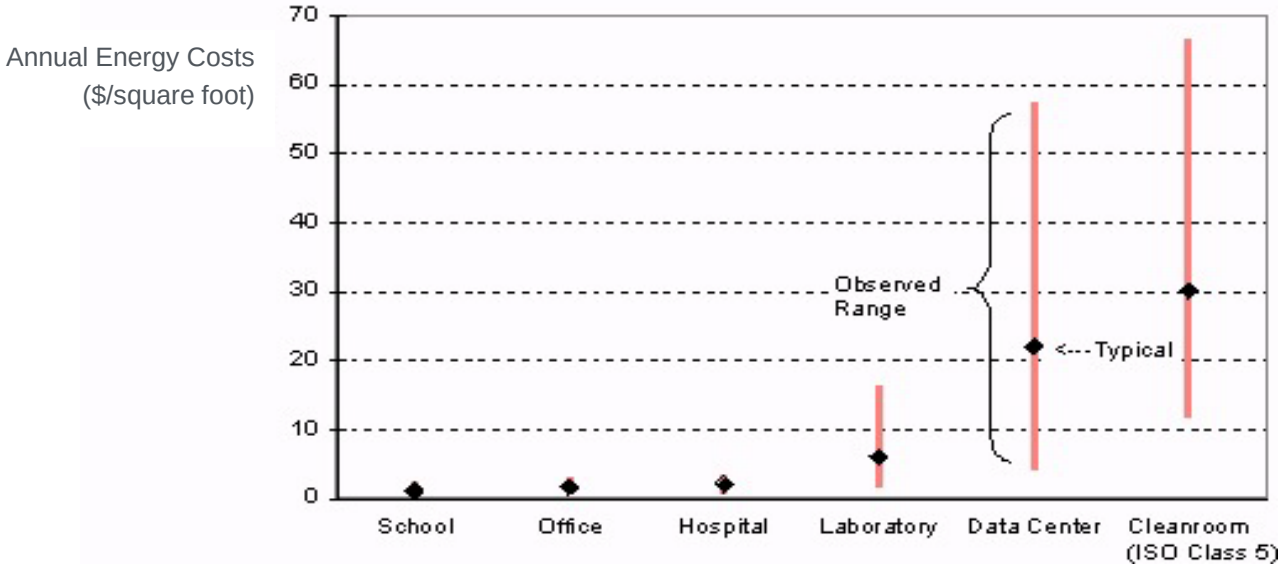
Dale Sartor, Lawrence Berkeley National Laboratory

www.femp.energy.gov/training

FEMP Federal Energy Management Program

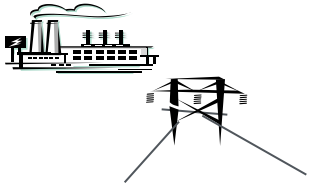
# High Tech Buildings are Energy Hogs

## Comparative Energy Costs
## High-Tech Facilities *vs.* Standard Buildings



# Energy Efficiency in Data Centers

# Opportunities for Energy Efficiency



**Power Conversion & Distribution**

High voltage distribution
High efficiency UPS systems
Efficient redundancy strategies
Use of DC power

**Server Load/ Computing Operations**

Server innovation
Virtualization
High efficiency power supplies
Load management

**On-site Generation**

On-site generation including fuel cells and renewable sources
CHP applications
(Waste heat for cooling)

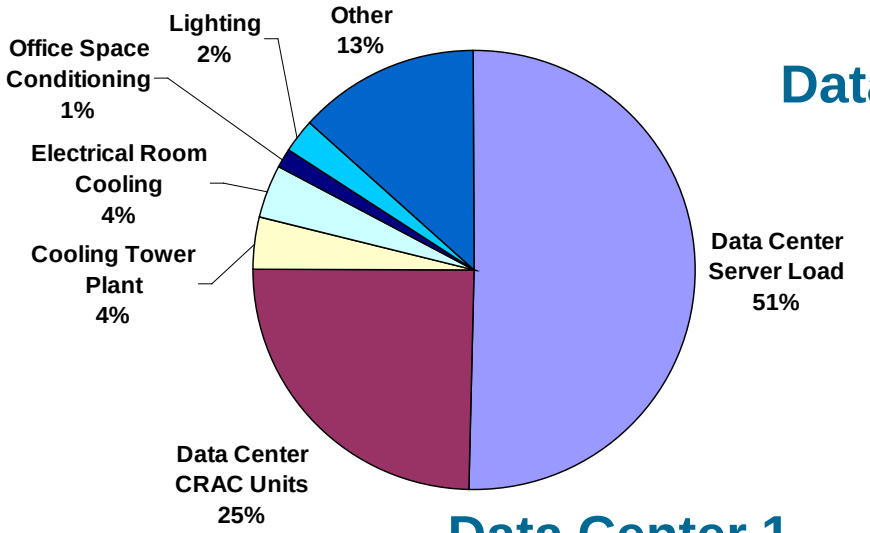
**Cooling Equipment**

Better air management
Move to liquid cooling
Optimized chilled-water plants
Use of free cooling
Heat recovery

# Potential Benefits of Data Center Efficiency

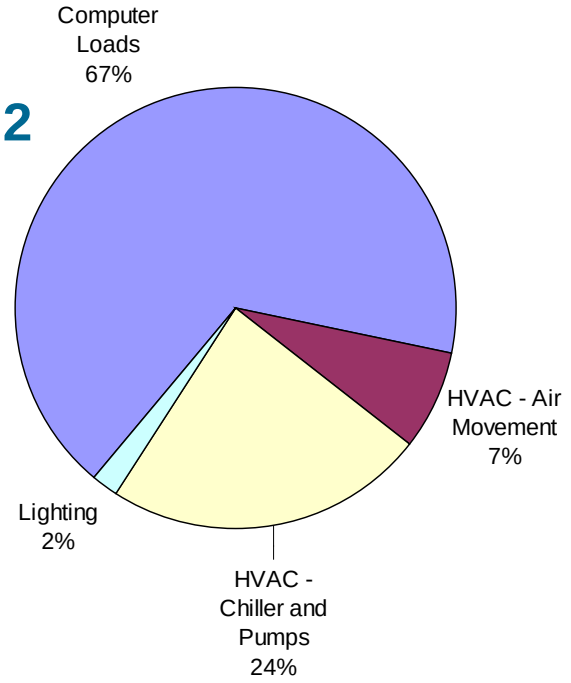
- 20-40% savings typical
- Aggressive strategies can yield 50+% savings
- Also extends life and capacity of infrastructures
- But is mine good or bad?

# Data Center Energy Usage Varies

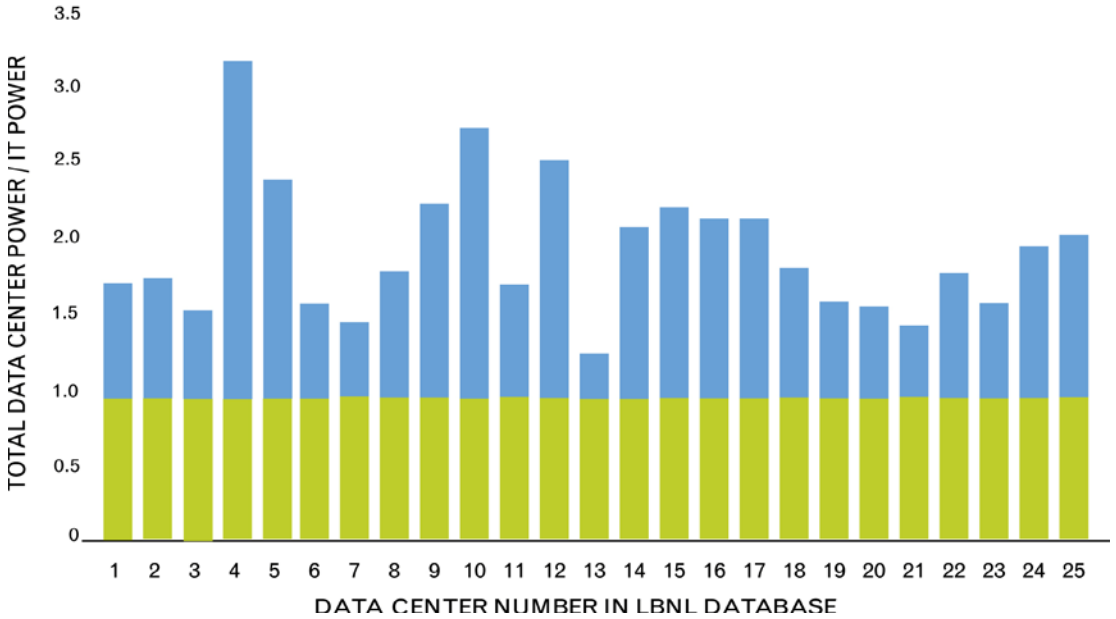



## Data Center 1

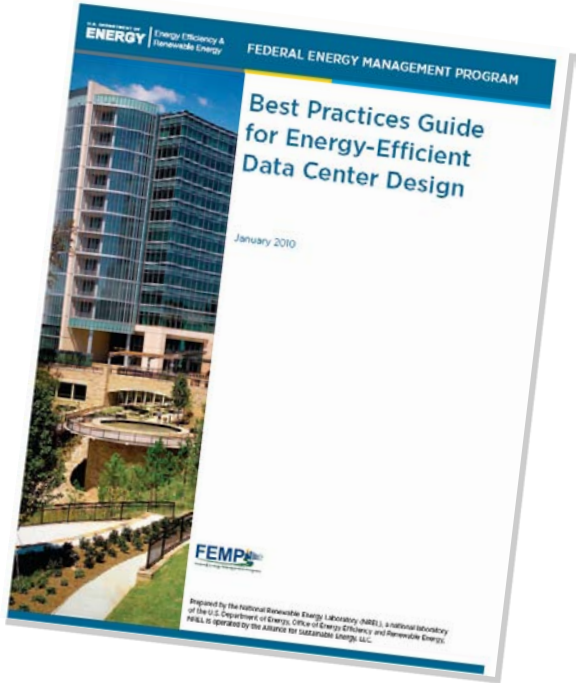
## Data Center 2



# High Level Metric: Power Utilization Effectiveness (PUE) = Total Data Center Power/IT Power



- Quick-Start Guide
- Analysis Tools
- Best Practices Guide
- Benchmarking Guide
- Data Center Programming Guide
- Technology Case Study Bulletins
- Procurement Specifications




**http://www1.eere.energy.gov/femp/program/dc_resources.html**

FEMP Federal Energy Management Program

http://www1.eere.energy.gov/femp/program/data_center.html

BERKELEY LAB

http://hightech.lbl.gov/datacenters.html

ENERGY STAR

http://www.energystar.gov/index.cfmc=prod_development.server_efficiency

Save ENERGY Now ®

http://www1.eere.energy.gov/industry/datacenters/

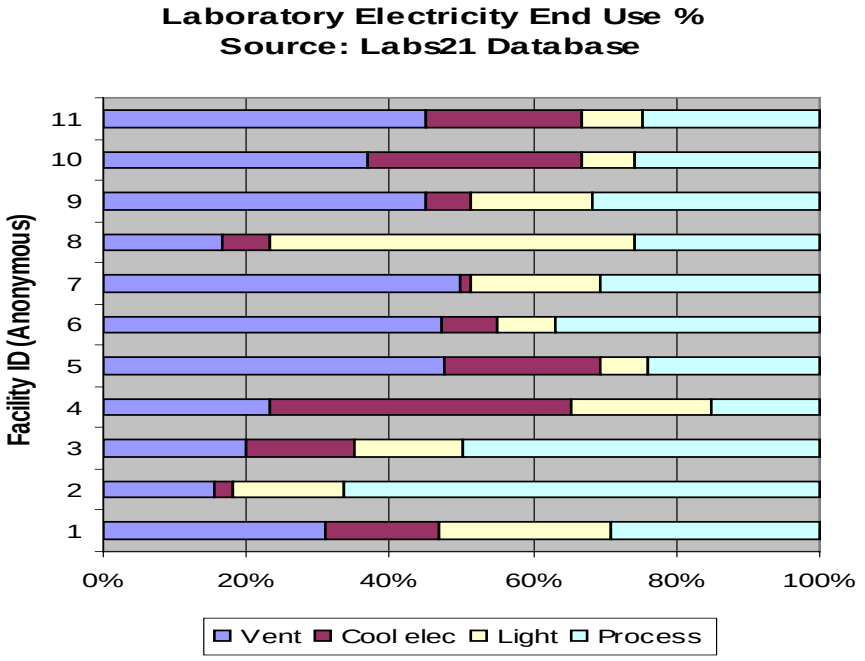
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

# Energy Efficiency in Labs

*Science and Technology Facility (S&TF), NREL, Golden, CO*

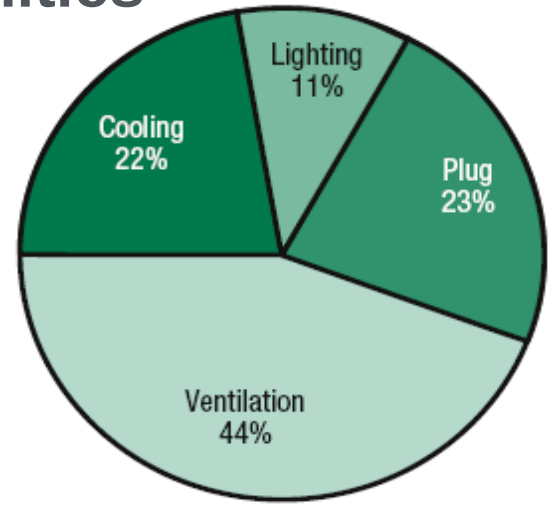
# Lab Energy Use Dominated by HVAC

- Ventilation is the largest component of energy consumption
- In some labs, a 10-20% improvement in ventilation is equivalent to total lighting energy use



# Five Biggest Opportunities

1. **Scrutinize the air changes:** Optimize ventilation rates
2. **Tame the hoods:** compare options
3. **Drop the pressure drop:** use lower pressure-drop HVAC designs
4. **Get real with plug loads:** right-size HVAC systems
5. **Just say no to re-heat:** Minimize simultaneous heating and cooling

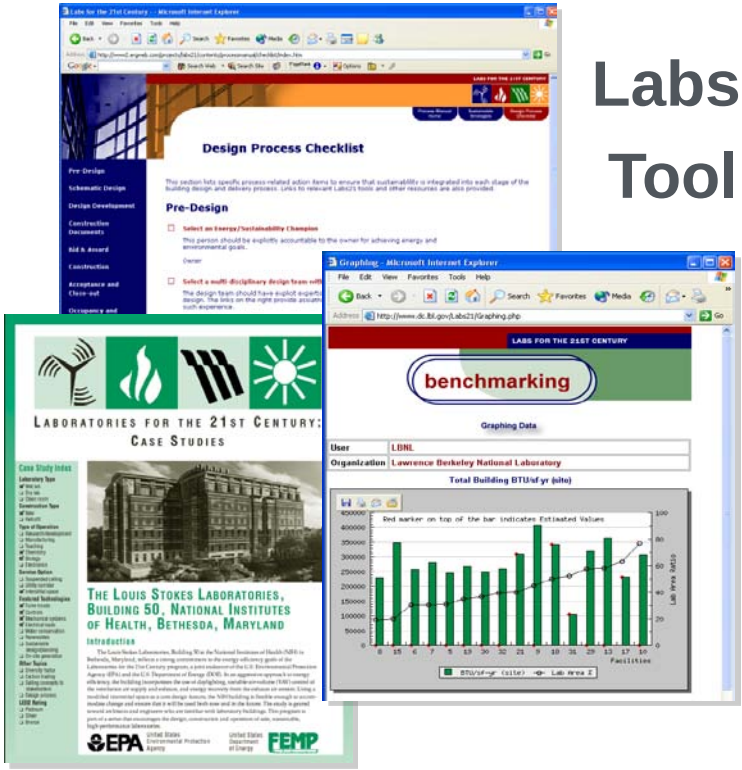



*Annual electricity use in Louis Stokes Laboratory, National Institutes of Health , Bethesda, MD*


Founded by the DOE Federal Energy Management Program and EPA Facilities Management and Services Division to improve the environmental performance of U.S. laboratories

- Optimize whole building efficiency on a life-cycle basis
- Assure occupant safety
- Minimize overall environmental impacts

**http://www.labs21century.gov**




# Labs 21 Toolkit

- **Core information resources**
  - Design Guide
  - Case Studies
  - Energy Benchmarking
  - Lab Energy Efficiency Profiler
  - Lab Equipment Efficiency wiki
  - Best Practice Guides
  - Climate Neutral Campuses
- **Design process tools**
  - Environmental Performance Criteria
  - Design Intent Tool
  - Labs21 Process Manual

**http://www.epa.gov/lab21gov/toolkit/**

# Contacts and Questions


## Will Lintner

Federal Energy Management Program

202.586.3120

william.lintner@ee.doe.gov

## Dale Sartor

Lawrence Berkeley National Laboratory

510.486.5988

dasartor@lbl.gov