LBNL Technical Support
To
Federal Agencies
For
Energy Management

March 2009

Overview

- ***LBNL Federal Agency Support Team: Primary Activities***
  - *Project Development/Alternative Financing*
  - *Technical Assistance*
  - *Labs & Data Centers 21*
  - *Utility Management/ Renewables*
  - *Technology Specialties*

Energy project assistance to Federal Agencies

project assistance to Federal Agencies

- **Project facilitation and/or technical support since 1997**
  - Energy management project development, implementation and financing; measurement and verification of savings.
- **Experience in ESPC, UESC, SES (Postal Service) and direct-funded projects**
  - > 120 alt. financed projects, resulting in > $500M investment in federal facilities
- **Lead Lab for M&V/QA&I**
  - Streamlining and strengthening M&V processes
- **Lead Lab for strategic analyses and new opportunities**
  - E.g.: aggregating small facilities, new construction, deploying emerging technology, non-building applications

Design Assistance at LBNL

- 42 energy efficiency design projects since 2001
- Cost sharing on 50% (~$400k total)
- Direct project savings to date of ~$500k/yr

Indian Health Services

- **Technical Assistance: Lighting, HVAC, and Control retrofits at two major facilities: Tahlequah, OK and Ft. Defiance, AZ**
- **Sustainability master planning for IHS expansion**

US Coast Guard Housing Retrofit

- 1000 houses in SF Bay Area
- Site audits, user survey and energy modeling
- 20% energy savings or $216,000/year

NOAA Pacific Region Center

- Reuse of existing buildings
- Potential for natural ventilation and cooling
- Energy Modeling using EnergyPlus

US Forest Service

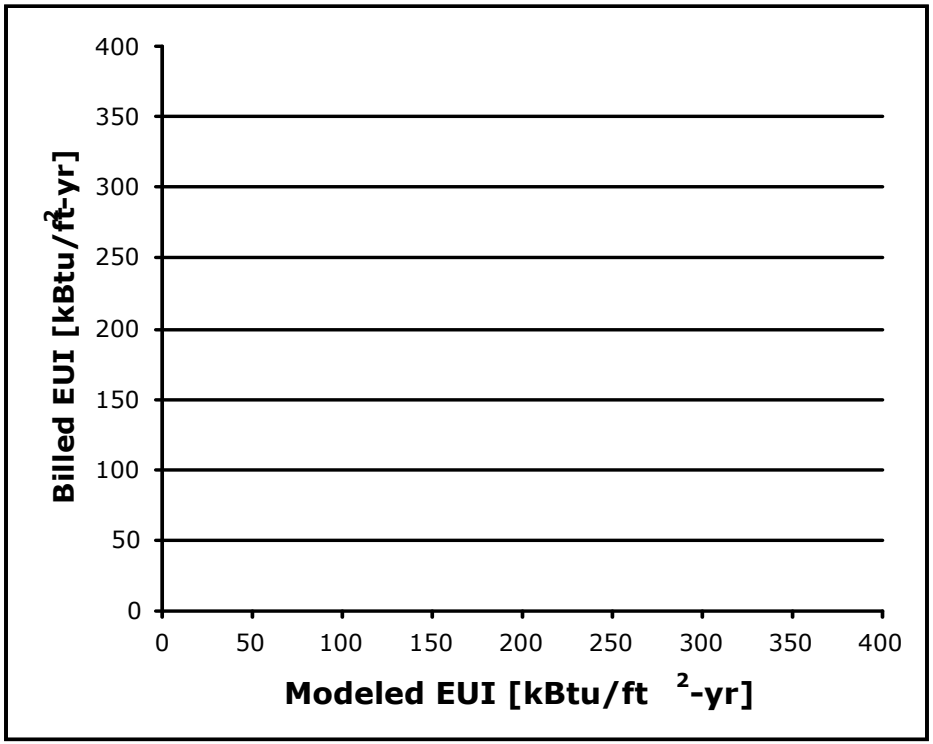
- Design assistance for new Visitor Centers, Lone Pine & Truckee, CA
- Daylighting, HVAC, Envelope, lighting, etc.
- Geothermal design coordinated with ORNL

Forest Service: Lighting Retrofit Guide

- Update NPS guide
- New technology and controls
- Economics and O&M

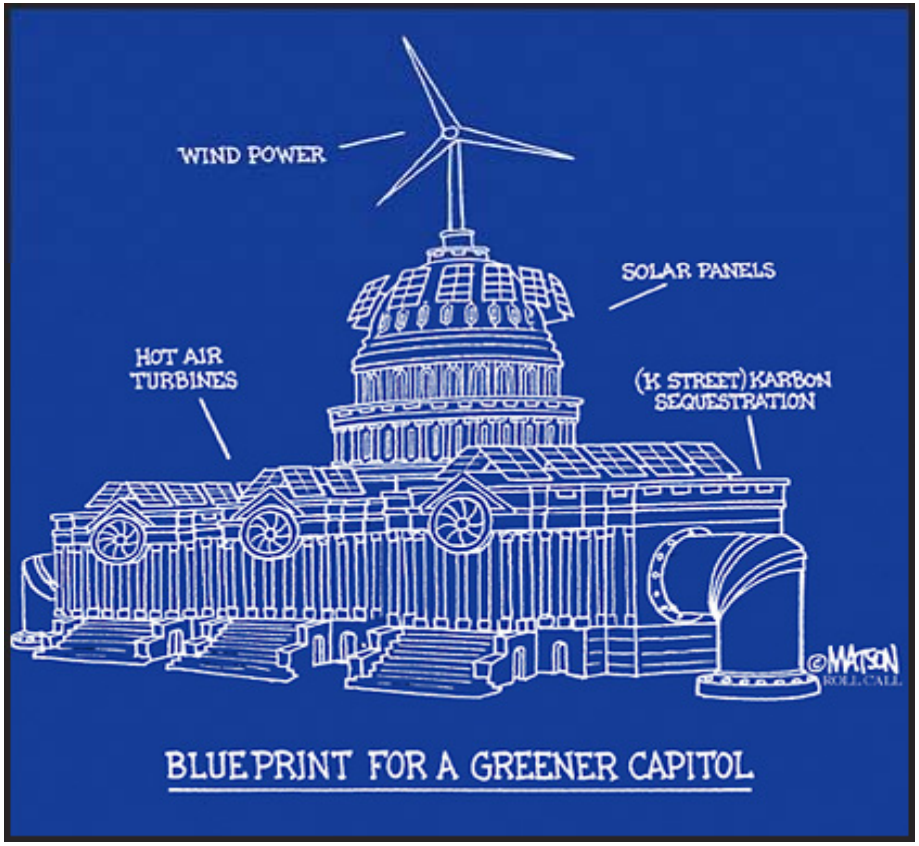
Energy Savings from LEED Federal Buildings

- 10 federal LEED buildings, 8 non-fed
- Average actual consumption for group w/in ~1% of modeled
- 27% savings beyond basecase



Greening the US Capitol

- Comprehensive plan for energy and carbon reduction
- Work with ESCO on duct sealing, HVAC measures
- Work at the Capitol Power Plant on efficiency measures



Efficiency Opportunities in Laboratories

- VAV fumehoods
- Low flow fumehoods
- Energy recovery
- Minimizing reheat
- Low pressure drop design
- Multi-stack exhaust

- Fumehood and laboratory Commissioning
- Indoor air flow modeling

- Optimizing air change rates
- Effluent dispersion
- Plug loads and rightsizing
- Lab equipment efficiency

- Daylighting in labs
- Effective electrical lighting design
- Flexible servicing configurations
- Green materials for labs

Toolkit

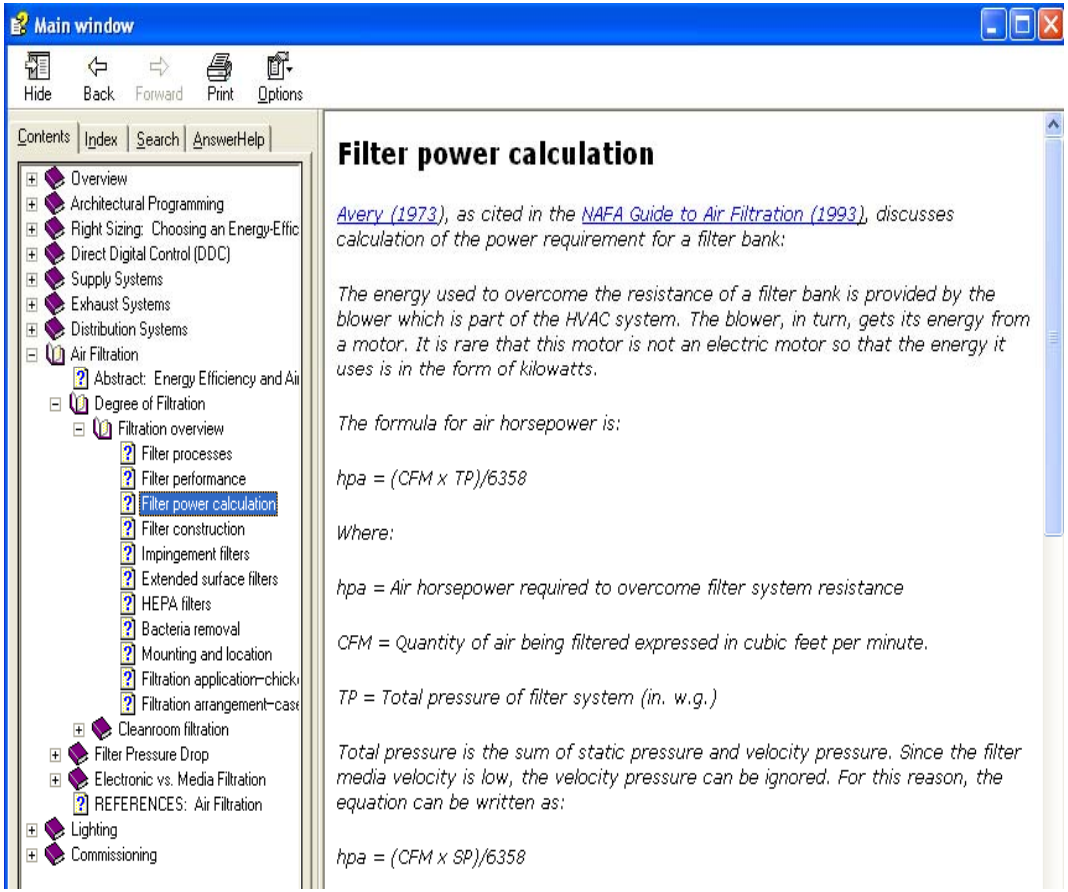
- **Core information resources**
  - Design Guide
  - Case Studies
  - Energy Benchmarking
  - Best Practice Guides

- **Design process tools**
  - Env. Performance Criteria
  - Design Intent Tool
  - Labs21 Process Manual

www.labs21century.gov/toolkit

Lab Design Guide

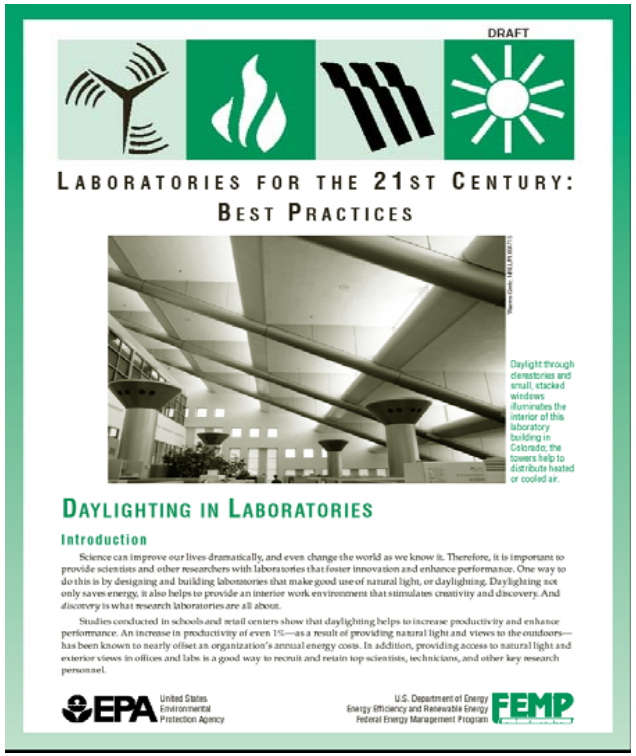
- A detailed reference on high-performance, low-energy lab design and operation
- Searchable
- Available on web and CD



Best Practice Guides

- **Describes how to implement a strategy, with implementation examples**

- **Completed guides:**
  - Combined Heat and Power
  - Daylighting in Laboratories
  - Energy Recovery
  - Low-pressure drop design
  - Modeling Exhaust Dispersion
  - Water Efficiency
  - Minimizing Reheat
  - Right-sizing



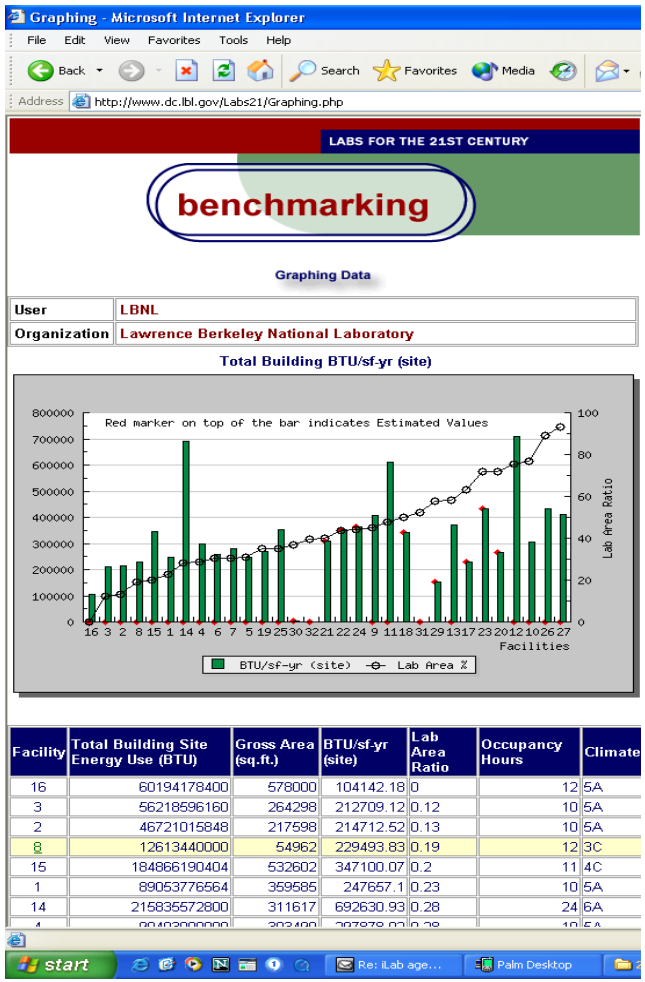
Case Studies

- Bren Hall, UCSB
- Fred Hutchinson Cancer Research Center
- Georgia Public Health Laboratory
- Haverford College Natural Science Center
- National Institutes of Health Building 50 Sandia National Laboratories PETL
- Nidus Center
- Pharmacia Building Q
- U.S. EPA National Vehicle and Fuel Emissions Lab
- Whitehead Biomedical Research Center, Emory University

All case studies have whole-building and system level energy use data

Energy Benchmarking Tool

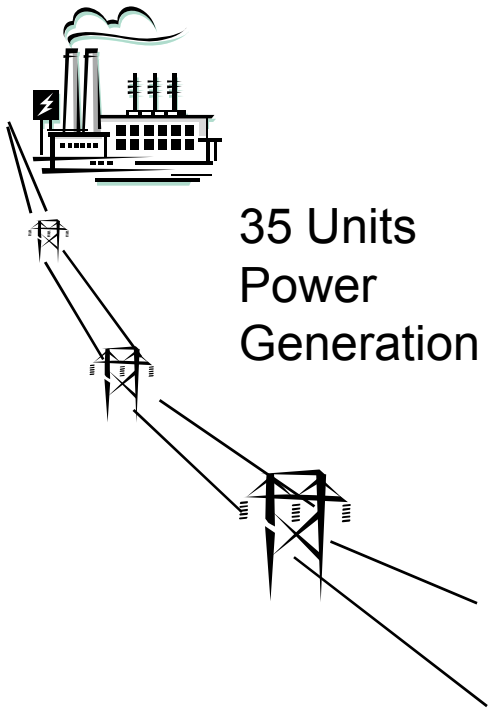
- National database of lab energy use data
- Web-based input and analysis
- About 70 facilities
- Building level data (e.g. Site BTU/sf)
- System level data (e.g. W/cfm)



Data Center Efficiency Opportunities

Energy Efficiency = Useful computation / Total Source Energy **= 15% (or less)**

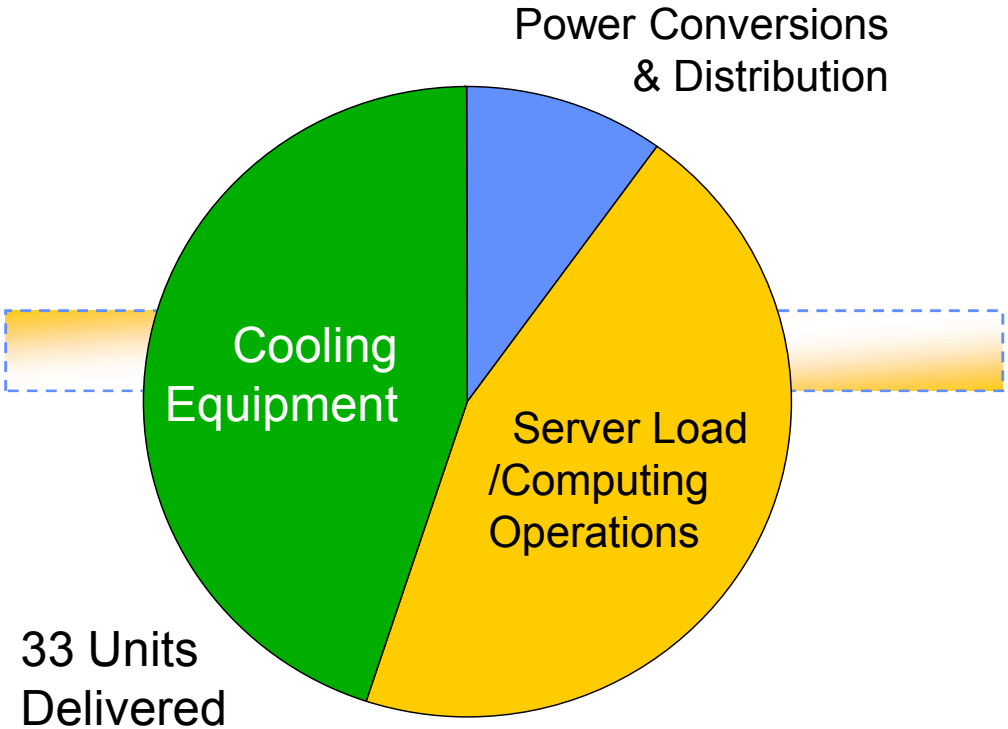
100 Units
Source Energy



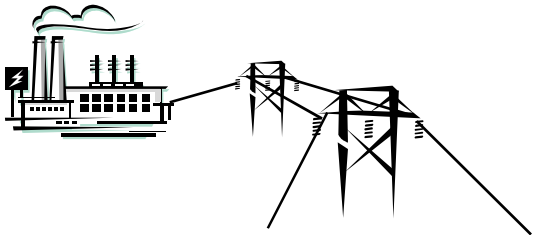
35 Units
Power
Generation

33 Units
Delivered

Typical Data Center Energy End Use



Energy efficiency opportunities are everywhere



Power Conversion & Distribution

- Load management
- Server innovation

Server Load/ Computing Operations

- Better air management
- Better environmental conditions
- Move to liquid cooling
- Optimized chilled-water plants
- Use of free cooling

Cooling Equipment

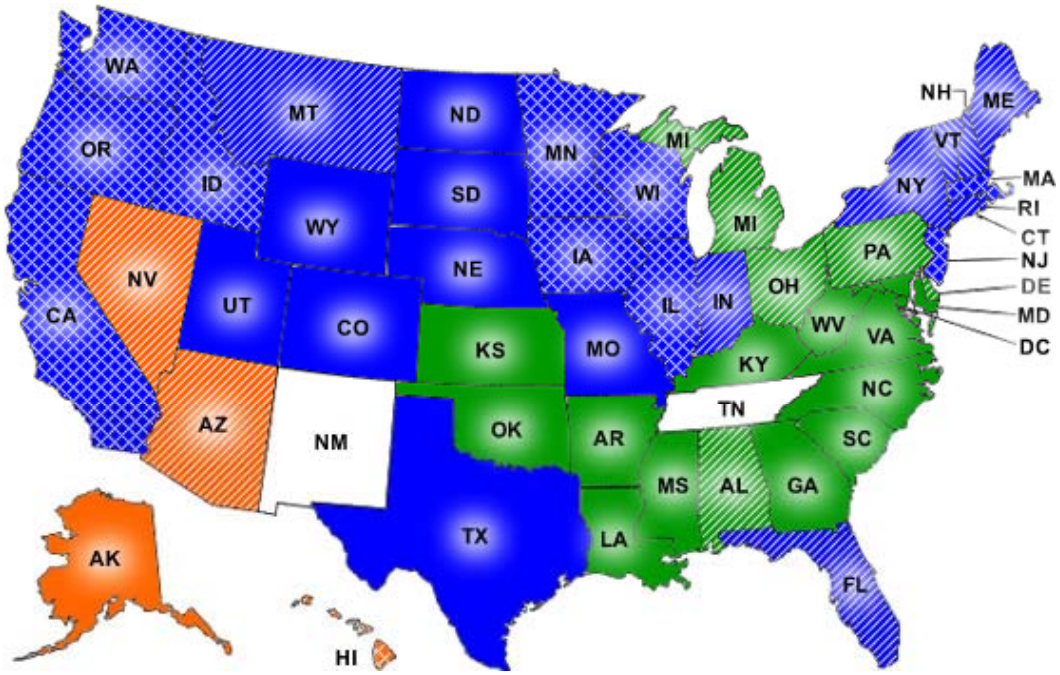
- High voltage distribution
- Use of DC power
- Highly efficient UPS systems
- Efficient redundancy strategies

Alternative Power Generation

- On-site generation
- Waste heat for cooling
- Use of renewable energy/fuel cells

FEMP Utility Management Website: Energy Efficiency and DR Programs

www1.eere.energy.gov/femp/program/utility/utilityman_energymanage.html



These states have both DR and EE programs

These states have DR programs only

These states have EE programs only

These states have dist. energy resource options

These states have gas efficiency programs

These states no energy management options

- **State-by-state information on funding opportunities for electric and gas energy efficiency, demand response, and distributed generation programs**
- **Programs sponsored by Utilities, Public Benefits Fund Administrators, State Agencies, ISOs**
- **Summary description and Web link for each program; updated annually**

GSA Philadelphia Custom House

Issue: GSA pays very high demand charge ($30/kW-mo) and "ratchet" …
and the impact of their tariff wasn't known

LBNL recommendation: "pre-cool" / "demand limit" protocol – chillers turned on early (2 A.M.) on hot nights and building operated w/ just one chiller rest of day (investment cost: $300 for 2 valves!)

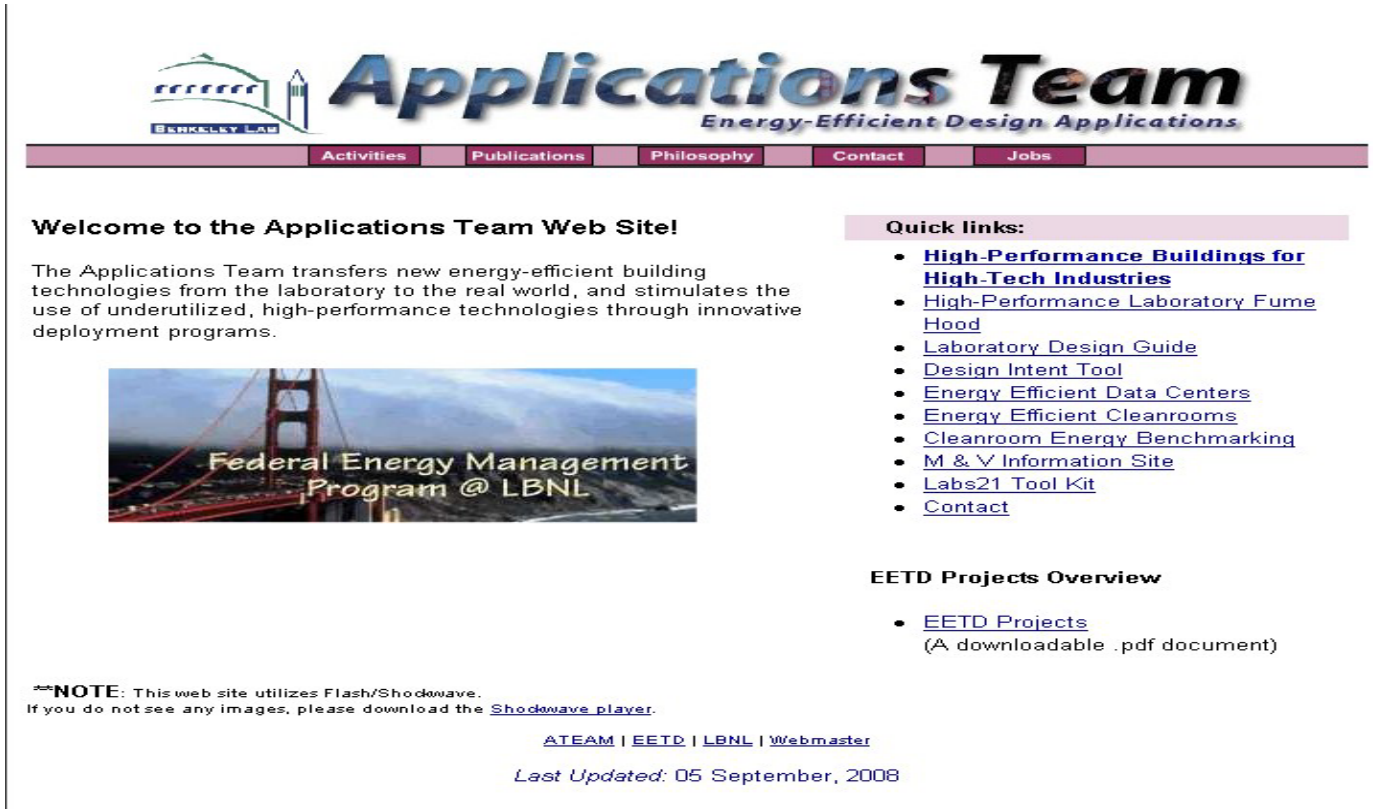
Results:

- **15-20% decrease in summer peak demand (~300-400 kW)**
- **Saved ~ $70,000 in 2005/06; saved ~ $100K in subsequent years**
- **Tenants "have never been happier"**

Lesson Learned: There are big $$$ savings from measures that save little or no energy … and gov't. is missing them

The Applications Team (ateam.lbl.gov)

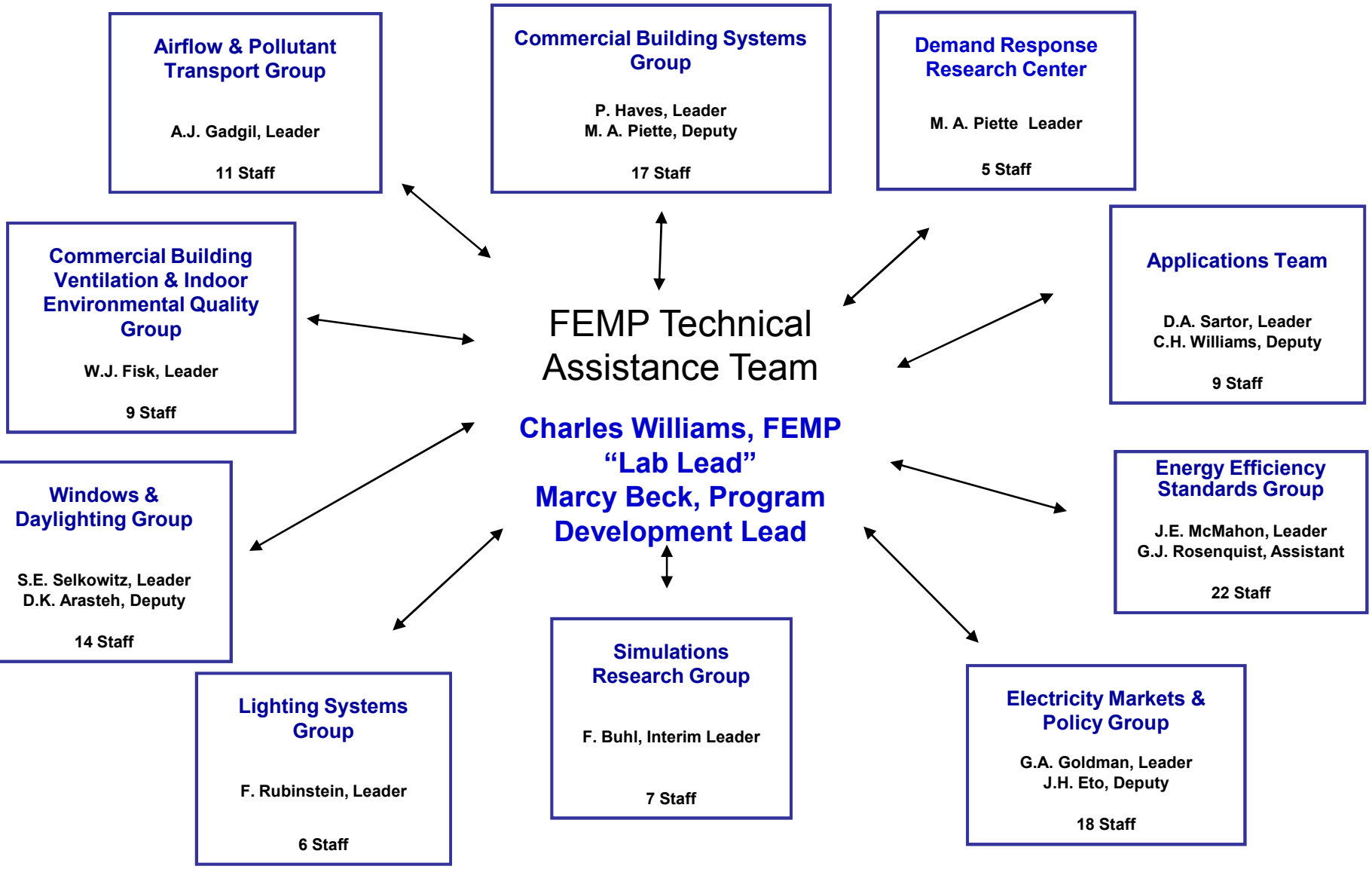
Mission: To transfer new energy efficient building technologies from the laboratory to the real world, and stimulate the use of underutilized, high-performance technologies through innovative deployment programs.



Support Model for Federal Agencies

- We do the Rocket Science
- Develop and disseminate knowledge, processes, and tools that empower agency clients
  - —New / advanced / specialized technologies
  - —Special expertise
  - —Development of new methods, protocols, procedures, etc.
  - —Field support for complex, specialized projects
- Avoid things others can do faster, cheaper

Technical Resources for FEMP and Agencies



LBNL Buildings R&D

- Advanced technology
  - —Lighting, Controls, Insulation, Fume hoods, Ducts
  - —Windows, Integrated façade systems (daylighting, natural ventilation)
  - —Indoor air quality
- Energy-efficient appliances and equipment
  - —Procurement, Standards
- High-performance buildings
  - —Action-oriented performance benchmarking
  - —Commissioning, monitoring and verification
  - —Remote information monitoring and diagnostics
  - —Equipment controllers and EMCS systems
  - —Specialized building types: Labs, Cleanrooms, Data Centers, Healthcare
  - —Nationwide EERE Data Center Initiative
  - —Green buildings
  - —Demand responsive buildings
  - —Simulation tools

R&D Impacts: New SF Federal Building

Project: **GSA/ Morphosis, Arup,…**

Outcome: **"Class A" office building;**

- **Comfortable work environment**
- **First cost savings, Operating savings**
- **Key: quantify performance and risk**

Extensive Energy design assessment

- **Extensive climate, energy modeling**
- **Comfort analysis under peak conditions**
- **CFD modeling for air flow details**

—Control system development, testing
—Commissioning process developed
—Post Occupancy Evaluations planned

Automated operable windows and night vent cooling -> no mechanical cooling for perimeter offices

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