Commercial Building Energy Alliances

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

CBEA Efficiency Forum

CBEA All-Member Meeting
Hospital Energy Alliance

May 23, 2012

National Renewable Energy Laboratory (NREL)
Golden, Colorado

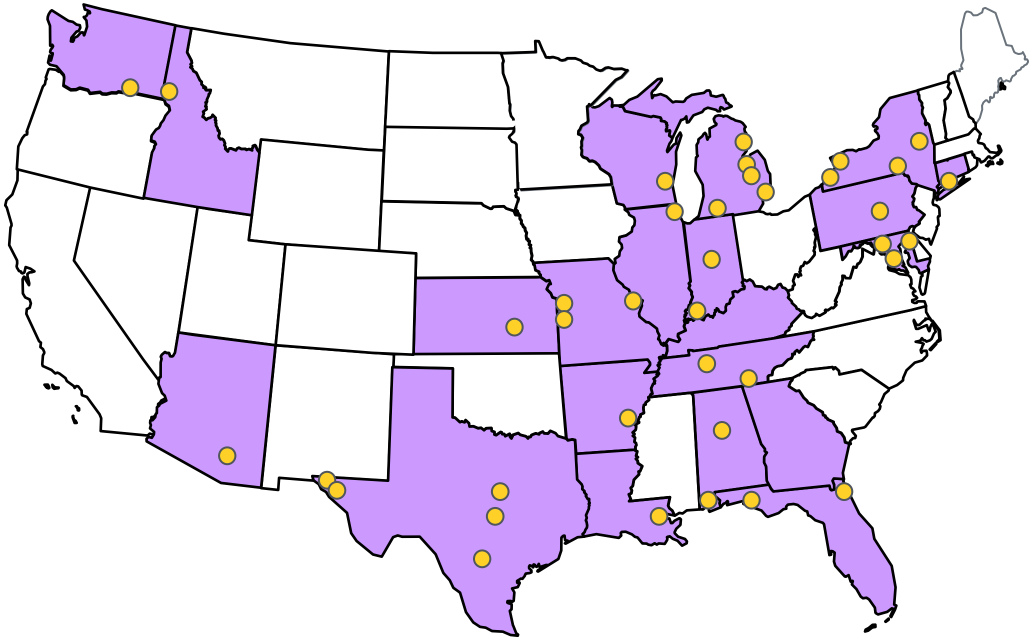
Ascension Health

- Largest Catholic health system, largest private nonprofit system, and third-largest system (based on revenues) in the United States, operating in 21 states and the District of Columbia
- Facilities and staff
  - 1,400 locations
  - 81 hospitals
  - 16,515 available beds*
  - 121,000 associates
  - 30,000 physicians*
  - 23,000 nurses*

** Not inclusive of Alexian Brothers Health System*

Ascension Health

- Financials (FY11)*
  - Total assets
    - $20 billion
  - Operating revenue
    - $15.6 billion
  - Operating income
    - $424 million
  - Net income
    - $1.5 billion



Care of Persons Living in Poverty and Community Benefit Programs: $1.2 Billion*

** Not inclusive of Alexian Brothers Health System*

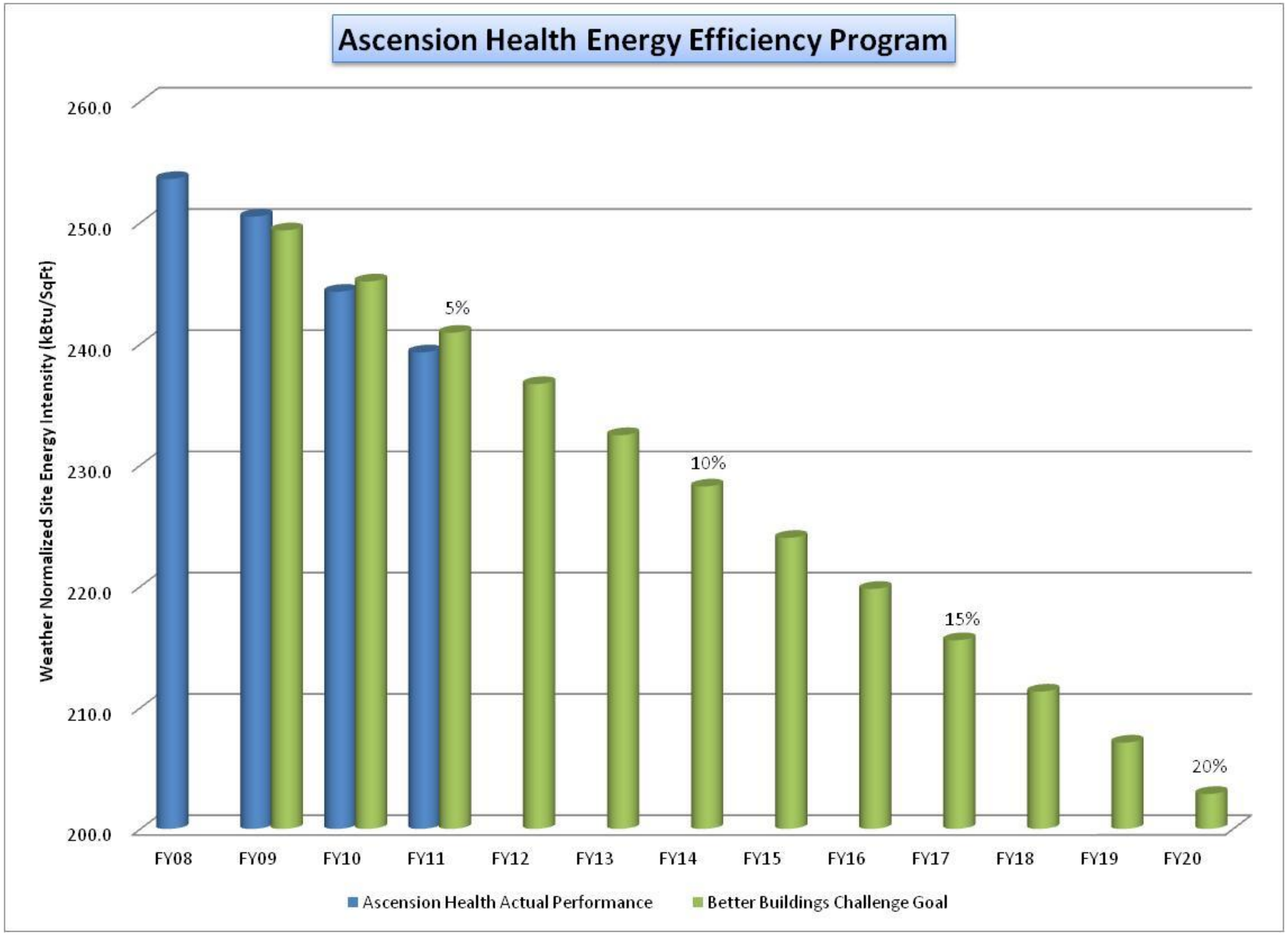
Ascension Health Energy-Efficiency Program

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

- Energy efficiency is one of nine categories within Ascension's Environmental Stewardship Program
- Ascension Health achieved a 5.6% reduction in energy use across 30 million square feet of buildings from FY08 to FY11
  - $10.1 million in cumulative cost avoidance
  - 168,583 tons of carbon dioxide were not emitted into the air
  - $1.95 million in direct medical expenses were not incurred by the local communities from respiratory, mercury, and related illnesses
- Implementations included lighting retrofits and a renewed focus on efficiently operating the central energy plant

Ascension Health Better Buildings Challenge

Goal: Achieving a 20% energy reduction as part of the Better Buildings Challenge; this goal yields $125 million in cumulative cost-avoidance at current utility rates

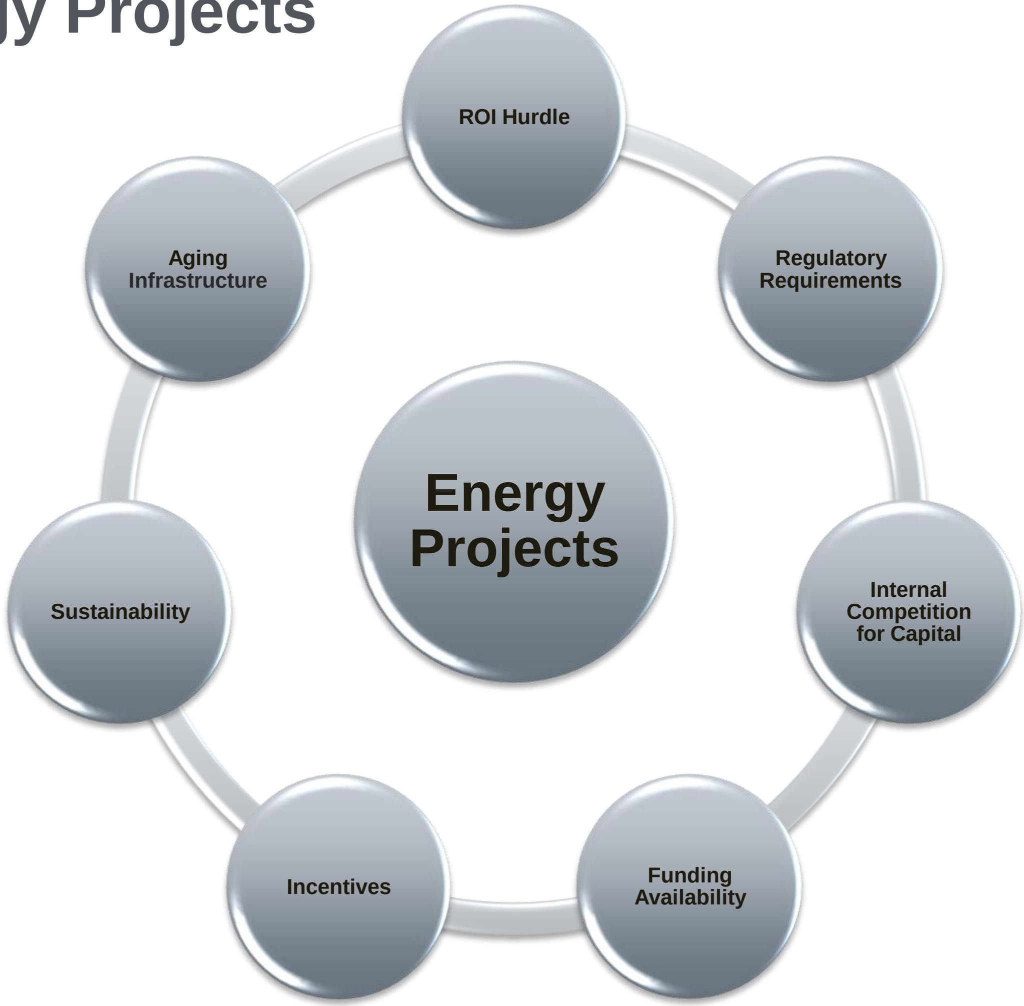


Ascension Health Facilities Infrastructure Pool

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

- Established in July 2010 (FY11).
- FIP was established to ensure that the facility infrastructure was maintained appropriately.
- Annual funding has varied between $30 million and $50 million.
- Capital funds are managed at the System level and allocated based on likelihood of failure and life-safety risk of failure.
- All projects are reviewed by one of Ascension Health's Preferred Engineering/Energy Consulting Firms.
  - Evaluate the system not just the equipment being replaced.
  - Make decisions based on lifecycle costs.

Marketing Energy Projects



Example 1

- **Justification Route**
  - ROI Hurdle
  - What we call a "JUST DO IT" project
  - IRR is above 8% with a pay back in 9/10’s of a year

UPMC Lighting Retrofit

Example 2

- **Justification Route**
  - *Regulatory Requirements, Incentives, Sustainability*
  - Modified IRR is less than 8%
  - Pay back period is less than 6 years
  - Governmental ban on T-12 production
  - Incentives PA Act 129
  - Energy reductions

UPMC Parking Garage Lighting

Example 3

- **Justification Route**
  - *Aging infrastructure, Regulatory Requirements, Incentives, Competition for Capital*
  - Modified IRR 8%
  - Pay back 4.03 years
  - Good comparison of new technology vs. existing

Example 4

- **Justification Route**
  - *<u>Sustainability, Incentive</u>*
  - Modified IRR is -7.8%
  - Pay back period is 8.25 years; 2.25 years over the 6 year limit
  - Good demo project
  - Incentive $127,000 from PEDA (PA Energy Development Authority)
  - Opportunity to understand geothermal practices and operations for future projects

Mayo Clinic – Downtown Campus

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

Mayo Clinic – St. Mary's Hospital

Present Focus

- Clinton Global Initiative (CGI)
  - Commitment - Retro Commission – 37 Buildings
- Benchmarking – KBTU/Sq Ft by Building
- Education

Present Source and Criteria

- Annual Budget Allocation for projects
- Project to have 3-5 year payback
  - Evaluate all benefits of improvements
  - Include operational benefits and depreciation life
- Each project must stand on its own merit
- Adding 2½ FTE’s

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

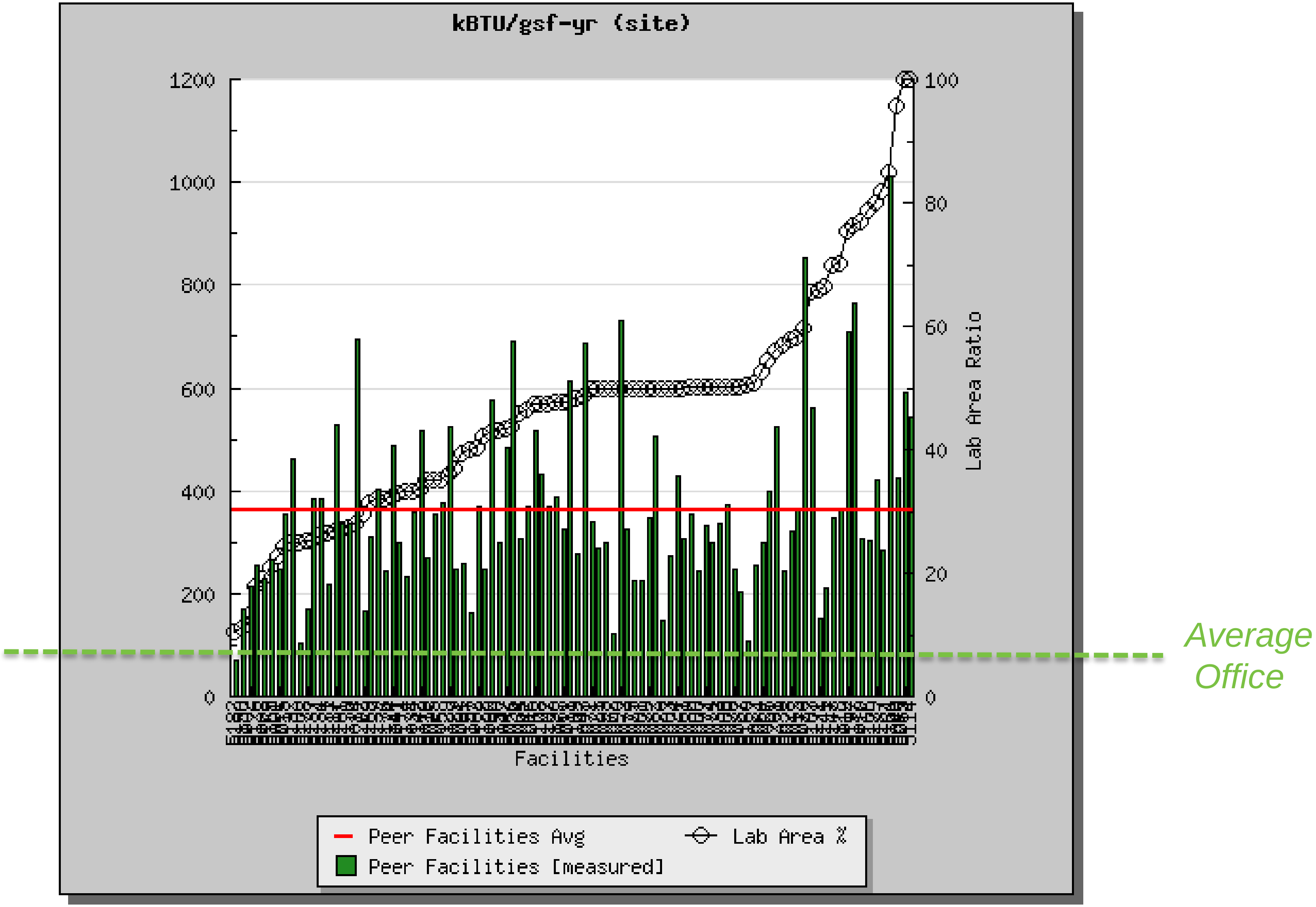
Projects

- Occupancy and time-of-day controls
  - Lights and ventilation
- Domestic water and heating-pump pressure control
- Fume hood management
- Exhaust air heat recovery
- Snowmelt control
- Pneumatic tube system blower control
- Chiller performance improvements—SMH
- Light fixture re-lamping
- Solar panel installation
- Outside air reduction

Laboratories Project Team

Labs – Energy-Intensive

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



Labs21 dataset: chemical, biological, chem/bio laboratories

Labs – Special (Mostly)

- Complex functional requirements
  - Health and safety
  - Research requirements

- HVAC and process loads are significant
  - Typically 6-10 air changes; can be 15-25 (offices are 1 ACH)
  - Can range from 2-20 W/sf (offices are 0.5-1 W/sf)
  - Lighting and envelope loads are relatively minor

- Substantial efficiency opportunities
  - 30-50% savings over standard practice
  - Many unique opportunities (low-flow hoods, etc.)

Labs Project Team Activities

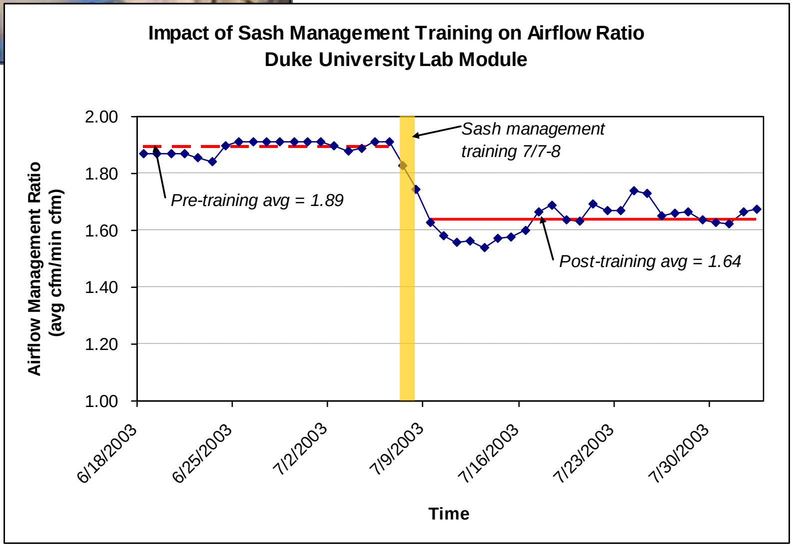
Near-term (2012) focus: Form a group of 8-10 CBEA partners to deploy, document, and disseminate four* high-impact strategies

1. **Shut the sash**
   Fume hood sash management

2. **Spare the air**
   Optimize minimum air change rates

3. **Just say no to reheat**
   Reduce simultaneous heating and cooling

4. **Ease the freeze**
   Laboratory freezer energy management

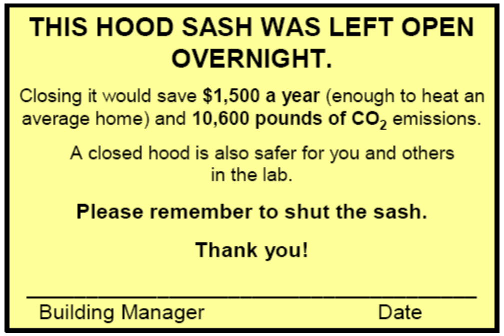


** Members commit to deploying two or more of these strategies*

1. Fume Hood Sash Management

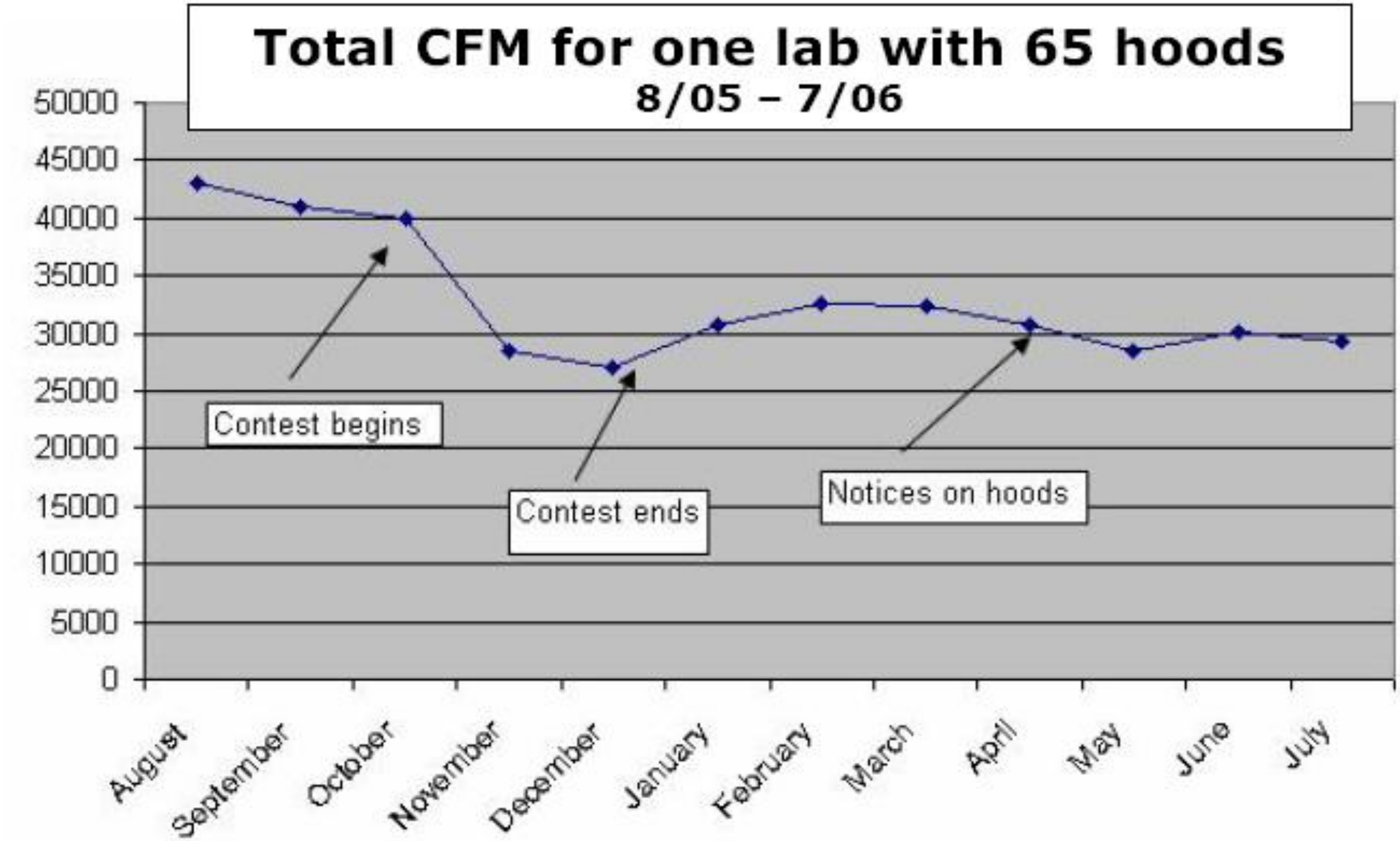
- Objective: Implement and institutionalize sash management strategies

- Drivers:
  - Fume hoods' energy use is significant in wet labs
  - VAV fume hoods are becoming common practice, BUT….. users often leave sashes open, wasting energy
    - A closed VAV hood uses up to 75% less energy than an open hood



Source: *UC Davis*

Impact of Sash Management Training



Source: *Harvard Green Campus Initiative*

Fume Hood Sash Management: Approach and Outcome

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

Step	Responsible
1. Identify laboratories - Labs with VAV hoods, hood-driven ventilation, measurable hood airflow or sash position - Identify key personnel – facilities staff and lab managers	**Partners**
2. Determine measurement protocol for baseline and savings - Based on data availability and desired accuracy - Will be used as basis for "shut the sash" competition	**DOE Team**
3. Determine sash management baseline	**Partners**
4. Compile sash management strategies and tools - Behavioral and technical approaches - Build on Labs21 guidelines	**DOE Team**
5. Implement sash management strategies - DOE team is available for guidance	**Partners**
6. Determine sash management savings - Using measurement protocol	**Partners**
7. Compile savings and recognize competition winners	**DOE Team**
8. Document and disseminate best practices	**DOE Team**

Outcome: Sash management energy savings and best practice guidelines

2. Optimize Minimum Air Change Rates

- Objective: Develop risk-management-based air change rate guidelines for academic labs

- Drivers:
  - Existing standards and guidelines provide wide latitude in determining minimum air change rates (ACR) in labs
  - ACR often set much higher than required
  - ACR can be optimized to specific risks in different lab types through “control banding”

Standards – Wide Range of ACR

Standard	Air change rate
ANSI/AIHA Z9.5	The specific room ventilation rate shall be established or agreed upon by the owner or his/her designee
NFPA-45-2004	Minimum 4 ACH unoccupied; occupied "typically greater than 8 ACH"
ACGIH Ind. Vent 24th ED., 2001	The required ventilation depends on the generation rate and toxicity of the contaminant, not on the size of the room in which it occurs
ASHRAE Lab Guide-2001	4-12 ACH
OSHA 29 CFR Part 1910.1450	4-12 ACH

Optimize Minimum Air Change Rates: Approach and Outcome

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

1. Identify EHS personnel for each member - Personnel should be authority having jurisdiction (AHJ) for ACR	**Members**
2. Compile and benchmark existing ACR practices for each member	**DOE Team**
3. Develop and document ACR guidelines based on risk management framework - Via discussions facilitated by DOE Team	**Members**
4. Implement revised ACR in member labs	**Members**
5. Determine savings from revised ACR - With guidance from DOE team	**Members**
6. Compile savings	**DOE Team**

Outcome: Air change rate guidelines for academic labs and documented savings from member implementation

3. Reduce Simultaneous Heating and Cooling

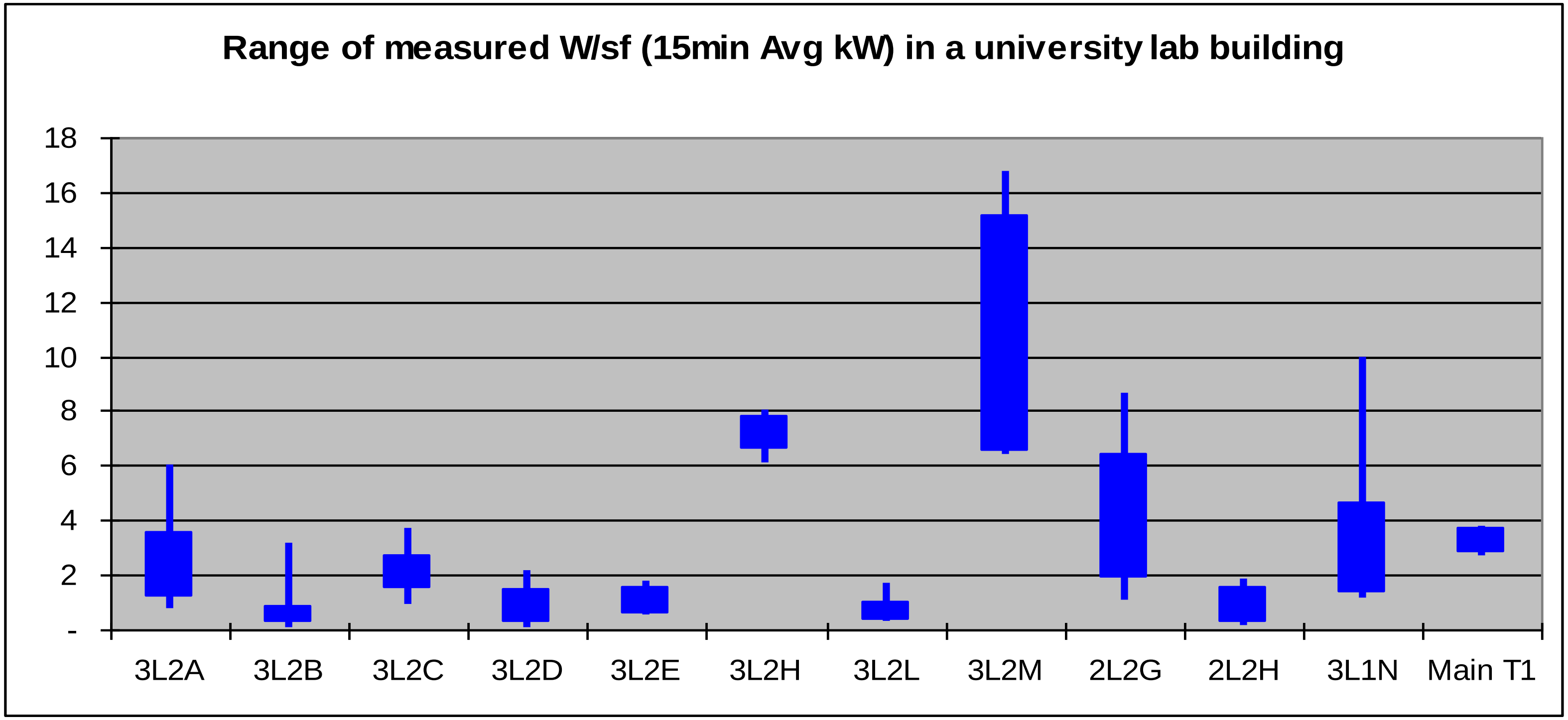
- Objective: Measure, track, and reduce reheat energy use in laboratories

- Drivers:
  - Reheat energy use can be high in labs due to wide diversity in plug loads and operating schedules
  - Reheat energy use often goes undetected

Wide Range of Plug Loads in Labs

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

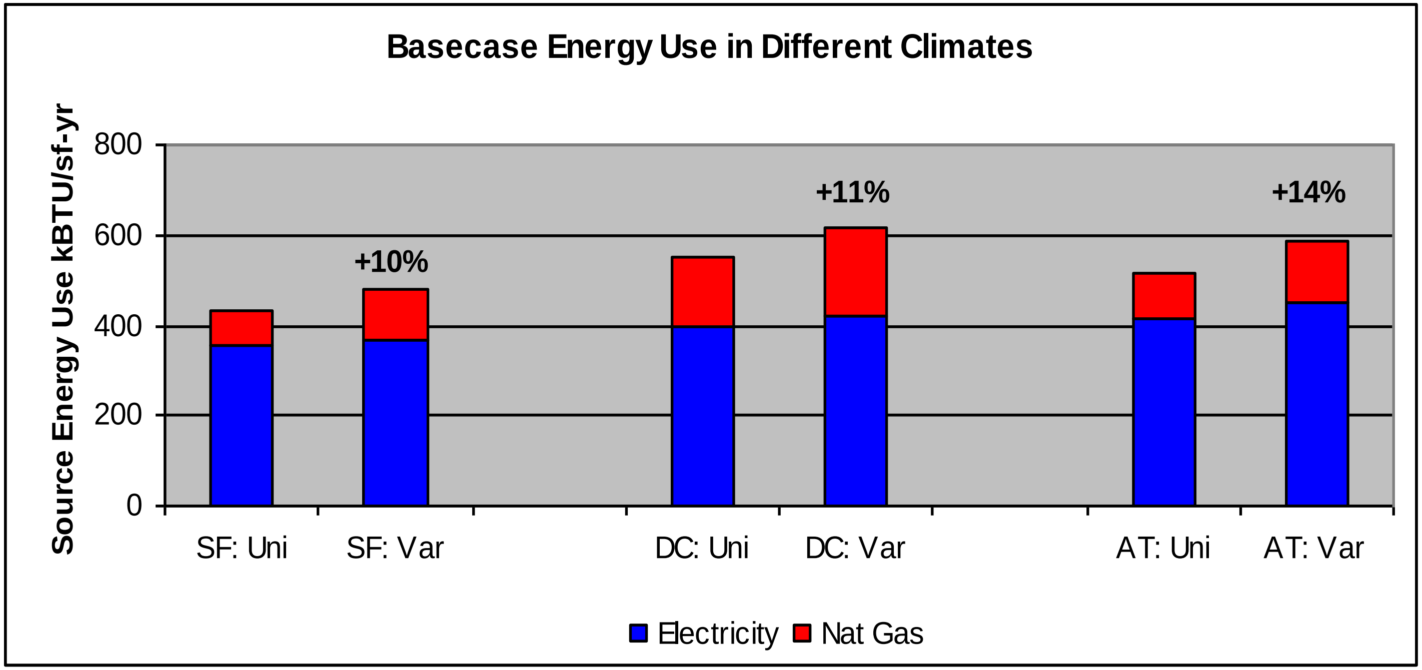
- High-load areas require lower supply air temperature, causing reheat in other spaces



Impact of Load Diversity on Reheat

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

- Energy simulation analysis of two cases
  - Uni: same (uniform) plugs loads in all lab spaces
  - Var: labs with high and low plug loads
- Impact varies by location, vent. rate, plug load



Track and Reduce Reheat Energy Use: Approach and Outcome

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

1. Identify candidate labs among members - Based on lab use and system type	**Members**
2. Determine method for measuring reheat energy use	**DOE Team**
3.Measure reheat energy use	**Members**
4. Develop and document approaches to minimize reheat energy use - Consider operational and retrofit options - Build on Labs21 best practice guide	**DOE Team**
5. Implement strategies, as appropriate for each lab context	**Members**
6. Measure post-implementation reheat energy use	**Members**
7. Compile savings	**DOE Team**

Outcome: Guidelines for measuring and reducing reheat in existing labs and documented savings from member implementation

4. Laboratory Freezer Energy Management

- Objective: Develop and implement strategies for freezer energy management

- Drivers:
  - Freezers are a significant portion of plug loads
  - Growth in the number of ultra-low freezers
  - Freezers are a 24/7 load that also adds to cooling energy use

Freezer Challenge Contest

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

Four Main Categories

- Temperature Tuning (DNA @ -20, Chill up to -70)
- Freezer Retirement and Upgrade
  - Decommissioning, energy-efficient ULF's
- Good Management (Spring cleaning, inventory, maintenance)
- Cutting Edge:
  - Sharing!
  - Inventory software
  - WiFi monitors
  - RTSS

Freezer Challenge Contest

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

Requires contest manager and "face time"

- One Point ~ 1 kWh
- Incentives: local gift cards; <1 y ROI; $1,000-5,000
- Lab outreach
- Promotional materials available, entry level welcome!
- Inventory ULF's through material management!
  - Contact UC Davis or CU Boulder to join!

Overviews:

- https://sites.google.com/site/labfreezercompetitioncuboulder/
- http://sustainability.ucdavis.edu/action/conserve_energy/store_smart.html
- http://sustainability.ucdavis.edu/news/2011/may/freezer_challenge.html
- http://ecenter.colorado.edu/greenlabs

Examples of materials available on-line:

- http://sustainability.ucdavis.edu/local_resources/docs/storesmart/freezer_challenge_brochure
- http://sustainability.ucdavis.edu/local_resources/docs/storesmart/intro_to_freezer_challenge
- http://www.cahigheredusustainability.org/program/documents/FinalGBOMRTues8FreezerWeekUCDUCSBCHESC2011_000.pdf

Freezer Energy Management: Approach and Outcome

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

1. Determine list of measures - Efficiency specs, room temperature storage, temperature settings, equipment retirement	**DOE Team**
2. Develop implementation guidelines for each measure - Consider linkages and interdependencies between measures - Savings measurement protocol	**DOE Team**
3. Determine baseline conditions	**Members**
4. Implement strategies	**Members**
5. Determine savings	**Members**
6. Compile savings	**DOE Team**

Outcome: Guidelines for freezer energy management measures and documented savings from member implementation

Contacts

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

Technical Lead:

Paul Mathew

LBNL

510- 486-5116

pamathew@lbl.gov

CBEA Lead:

Kristen Taddonio

DOE

202-287-1432

Kristen.Taddonio@ee.doe.gov

APPENDIX

Freezer Specifications

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

DOE has developed advanced procurement specifications to help members address efficiency when purchasing new products.

- Draft specs have been developed for Fume Hoods and Ultra-low Temperature Laboratory Freezer
- Next step is to gather feedback
  - Specs will be distributed for comment to CBEA members next week
  - Specs to be updated with member and manufacturer input and finalized in August
  - Potential of working with DOE in the future on field monitoring of specified equipment
- For more information, contact Dan.Chwastyk@navigant.com

Freezer Stakeholder Issues

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

- Best Practices Guides and Tools
  - Reject heat guidelines for HVAC and scientists
  - Storage guidelines based on science—NIH $$
  - Measurement protocol
  - Monitoring of ULF performance
  - Sample management
  - RTSS, Freeze Drying, -20 degrees
- Technology – e.g., hydrocarbon refrigerants, Stirling cooling
- Financing efficiency – purchasing, energy and space responsibility
- Third-party uniform testing (for consumption, etc.) – Information public and promoted
- Proactive advice on cold chain regulations