Better Buildings Webinar Series

We'll be starting in just a few minutes….

Tell us…please send your response to the webinar organizers via the question box:

What topics are you interested in for future webinars?

Better Buildings
U.S. DEPARTMENT OF ENERGY

U.S. DEPARTMENT OF
ENERGY

Fall Tech Trends: Promising New Products from DOE's High Impact Technologies Catalyst Program

September 13, 2017

3:00-4:00 PM ET

Overview and Agenda

- Welcome & Introductions

- Presentations

    - U.S. Department of Energy

    - A.O. Smith Corporation

    - Lawrence Berkeley National Laboratory

- Additional Resources

- Question & Answer Session

Better Buildings
U.S. DEPARTMENT OF ENERGY

U.S. DEPARTMENT OF ENERGY

Today's Presenters

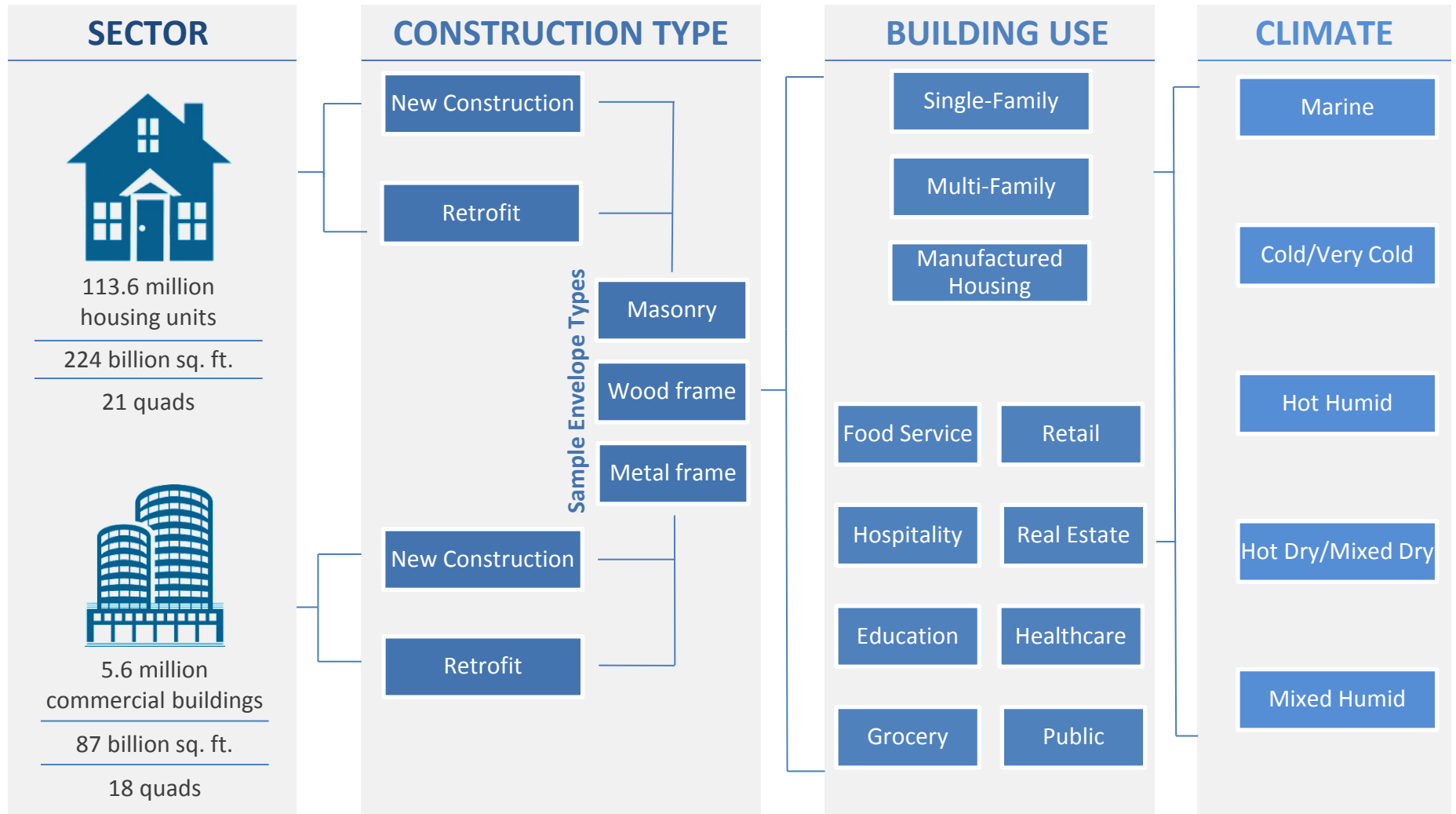| Name		Organization
Amy Jiron		U.S. Department of Energy
Kris Jorgensen		A.O. Smith Corporation
Cynthia Regnier		Lawrence Berkeley National Laboratory

Amy Jiron

U.S. Department of Energy

Commercial Buildings Represent Significant Opportunity

- $410 billion/year

- 75% of the nation's electricity

- Contributes 40% of greenhouse gas emissions

Building efficiency products represent $60 billion in U.S. revenue; up 43% over the last 4 years.

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

But Finding the Next Big Thing is Complicated!

SECTOR

113.6 million housing units

224 billion sq. ft.

21 quads

5.6 million commercial buildings

87 billion sq. ft.

18 quads

CONSTRUCTION TYPE

New Construction

Retrofit

New Construction

Retrofit

Sample Envelope Types

Masonry

Wood frame

Metal frame

BUILDING USE

Single-Family

Multi-Family

Manufactured Housing

Food Service

Retail

Hospitality

Real Estate

Education

Healthcare

Grocery

Public

CLIMATE

Marine

Cold/Very Cold

Hot Humid

Hot Dry/Mixed Dry

Mixed Humid

Sample Technology Areas (Gas and Electric)

High Impact Technology: A Strategic Approach

Goal: identify and prioritize cost-effective, underutilized, energy-efficient technologies

Strategic Emphasis: accelerate underutilized technologies into the market through pre-identified and pre-defined pathways
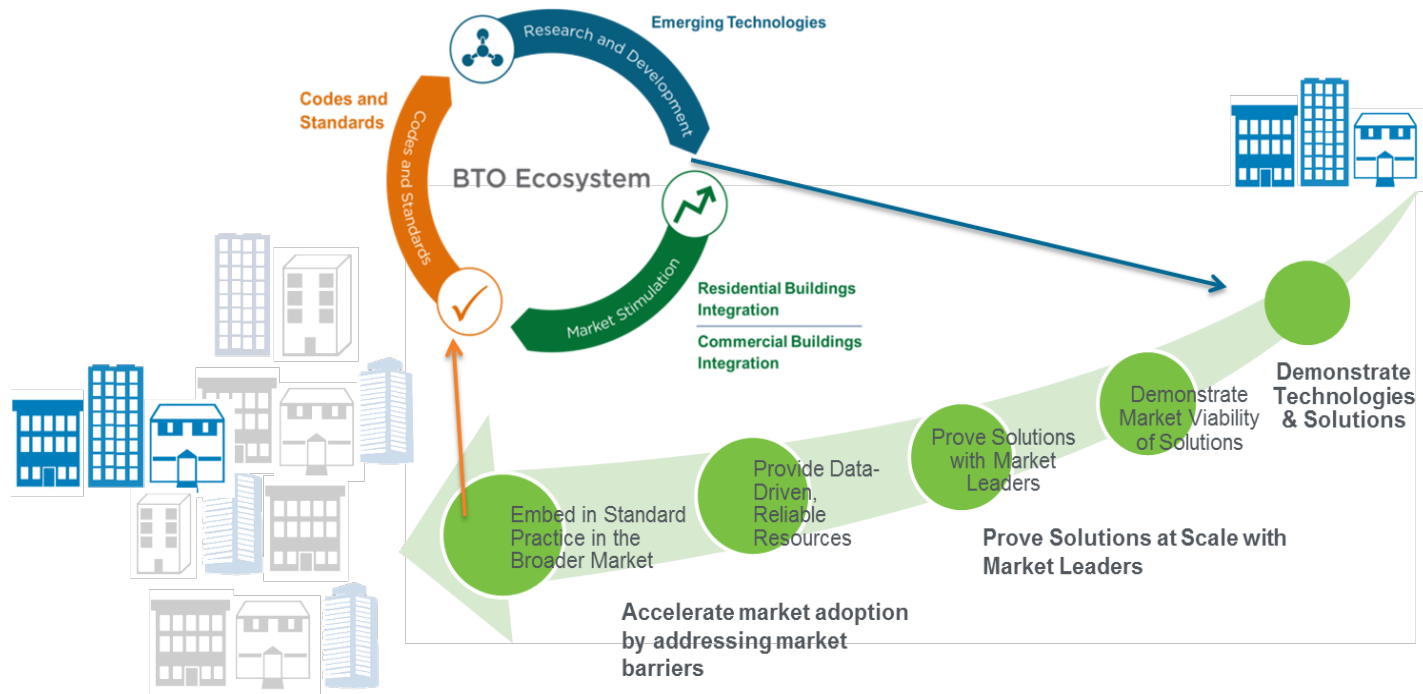
# Market Transformation: Relationships and Outcomes

Activity   **Outcome**

Technology Challenge

Theory of Impact: Match demand with innovation.

Manufacturing Specification

Metric: New Products

Technology Demos

Theory of Impact: Verify performance of emerging tech in real buildings.

Case Studies

Metric: Results and Case Studies Presented

Technology Procurement

Theory of Impact: Template language outlines performance and application characteristics.

Specifications & Guidance

Metric: Technical specs produced to set performance levels

Technology Campaign

Theory of Impact: Resources, technical assistance and sharing of best practices.

Installations

Metric: Commitments to retrofit or replace; leaders receive national recognition

Key Outcomes

Answer Unmet Market Needs (*leading to availability of more energy savings***)**

Greater Organic Adoption of HITs (*leading to greater energy savings***)**

HITs Incorporated Into Voluntary Programs *(leading regional and national focus on priority techs)*

HIT data considered in Utility Analysis *(catalyzing adoption for energy savings and cost effectiveness)*

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

Kris Jorgensen

A. O. Smith Corporation

AOSmith

Better Buildings Webinar

September 13th, 2016

Kris L. Jorgensen

What is Micro-Combined Heat and Power (µCHP)?
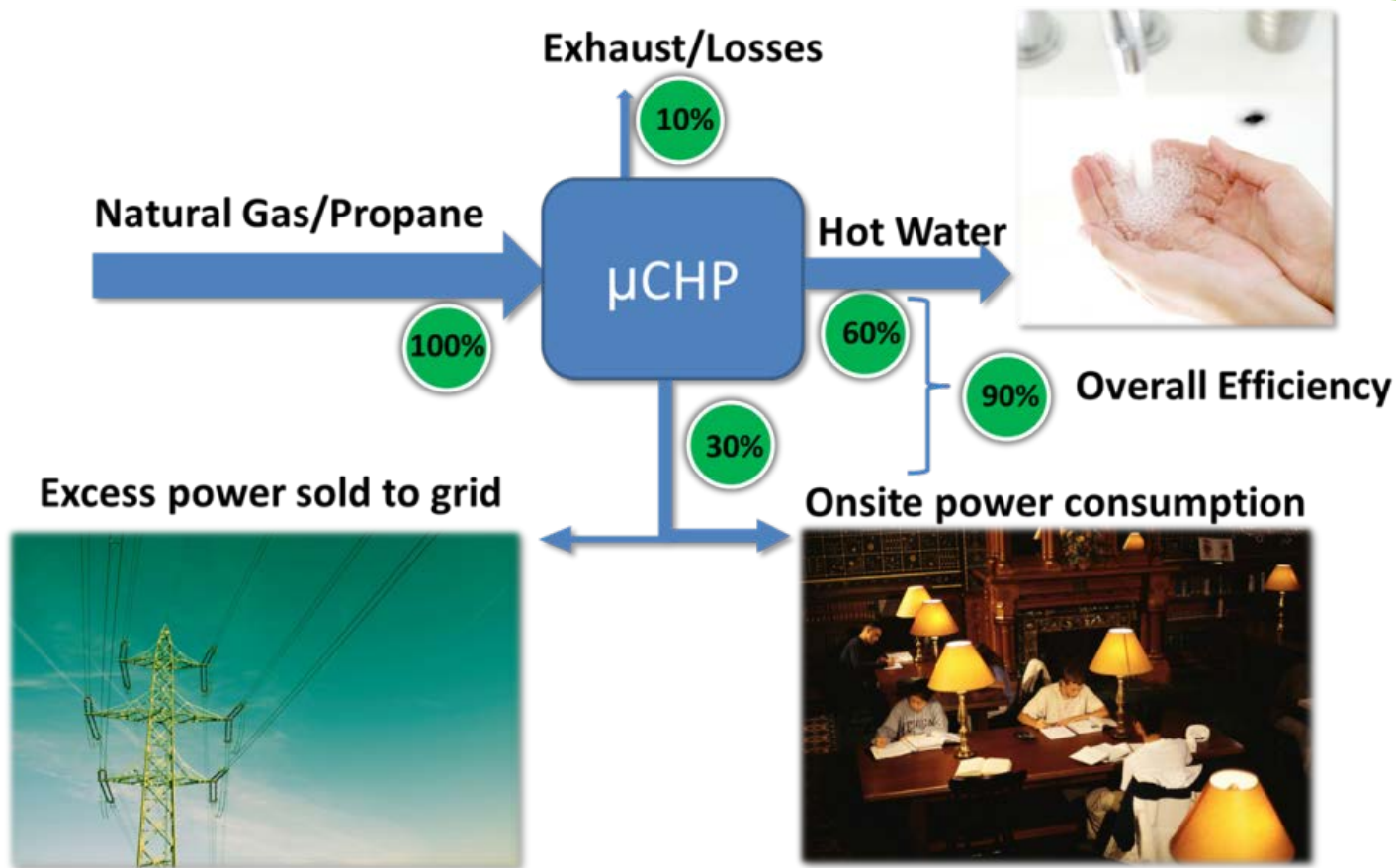
*Systems <50kW are classified as "micro"

Why Does µCHP Matter?
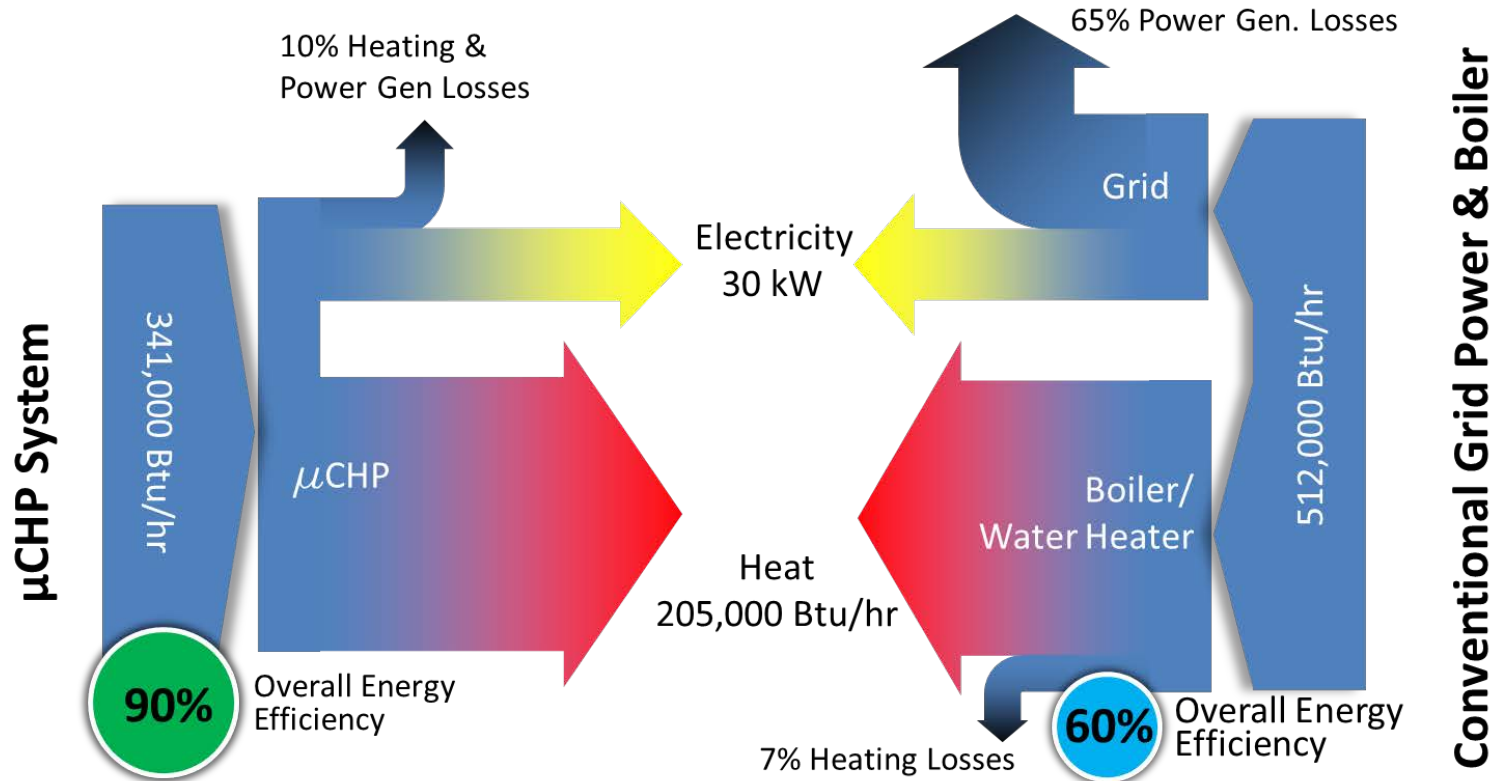
33% Source Energy Savings

Value of µCHP
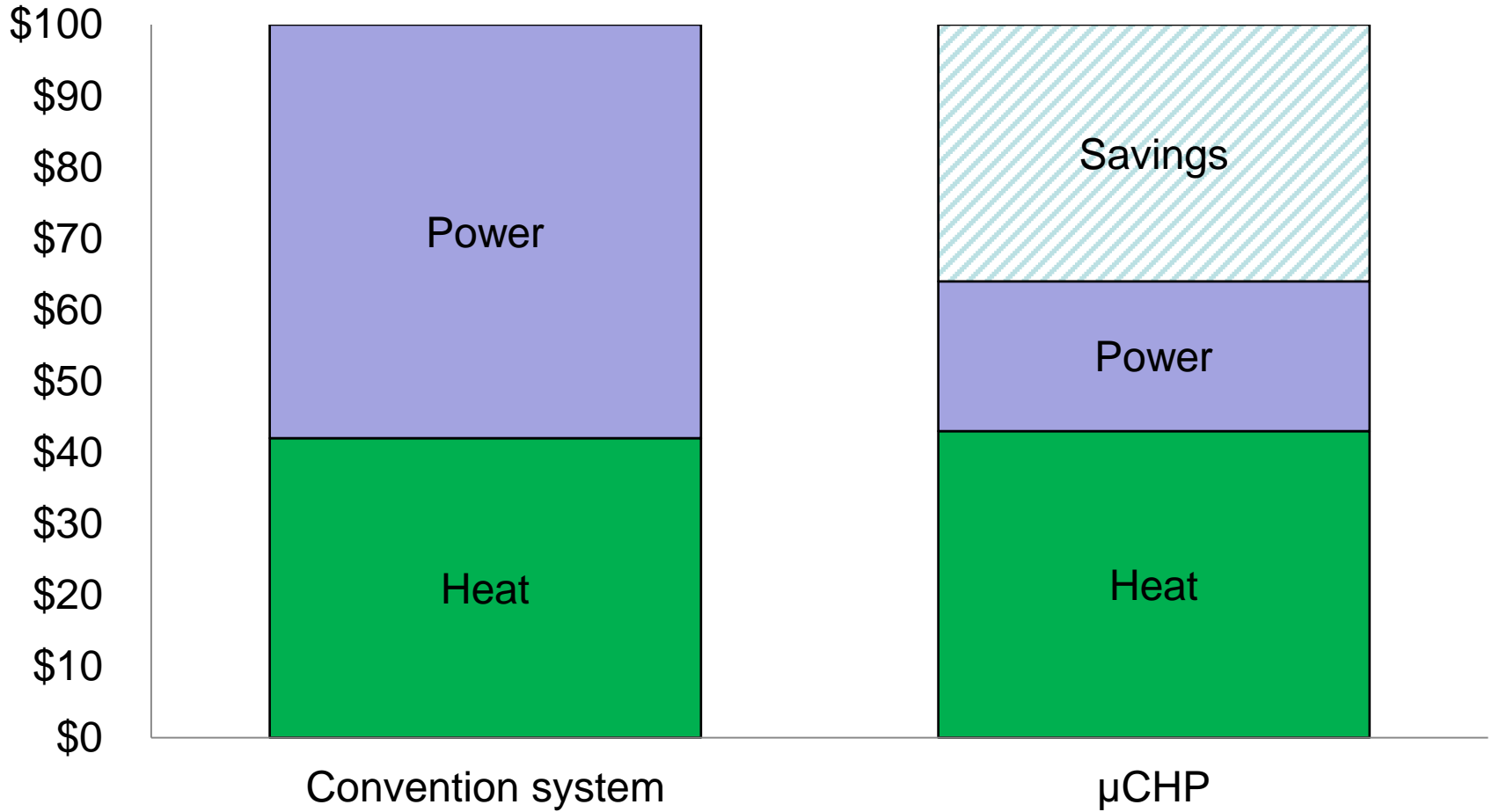
High Value Markets

Health/Fitness

Hospitality

Assisted Living

Multi-Family Housing

High Value Conditions

- High Thermal Load
- High Spark Spread
  - High electric and low gas prices
- Favorable Regulatory Environment
- Net Metering
- Incentives
  - Federal ITC 10%
  - Special gas rates

Project Summary

Timeline:

Start date: October 1, 2014
Planned end date: March 31, 2018

Budget:

DOE: $675,000
Cost Share: $863,300
Total: $1,538,300

Target Market/Audience:

Domestic Hot Water (Multifamily Housing, Lodging, Foodservice, Healthcare/fitness)

Space Heating

Key Participants:

AO Smith/Lochinvar
Engine Manufacturers
Oak Ridge National Lab
DOE-Office of Energy Efficiency and Renewable Energy (EERE)
Individual Sites and Utilities

Project Goal:

Provide stake-holders with the information needed to build a sustainable market. Specifically:

1. Verify value proposition of a three year installed cost payback
2. Identify and simplify installation and maintenance
3. Create effective training for installation & maintenance personnel

AOSmith

Installation Sites

Commercial Laundry
Rapid City, SD

Senior Community
St. Cloud, MN

Resort Hotel Kitchens
Acme, MI

Multi-Family High-rise
NYSERDA, Brooklyn, NY

Out Patient
Surgical Center
Focus on Energy
Waukesha, WI

Fitness Club
Focus on Energy
Milwaukee, WI

Multi-Family
NYSERDA, Jamaica, NY

21 kW

30 kW
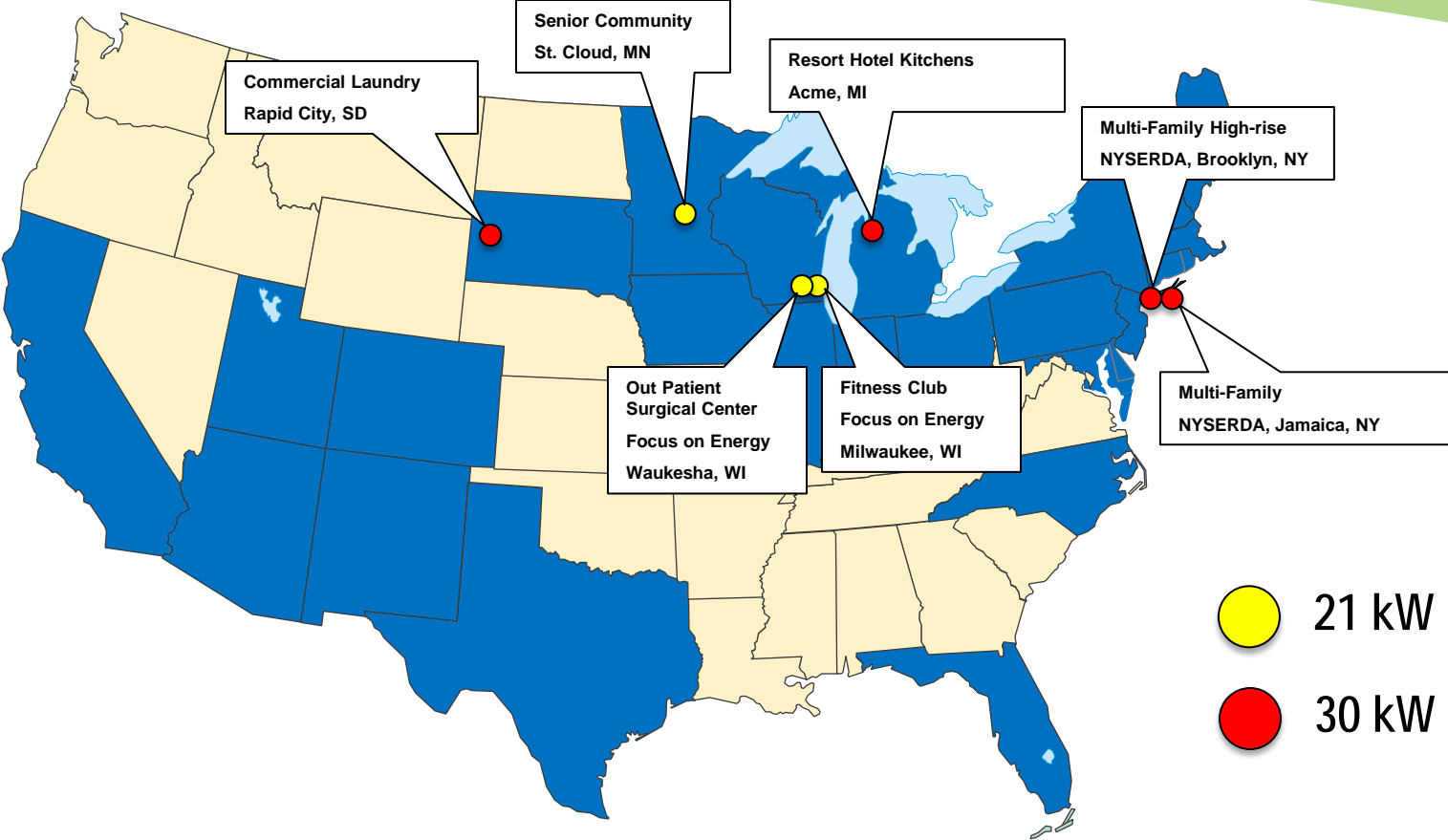
Hotel Resort Demonstration
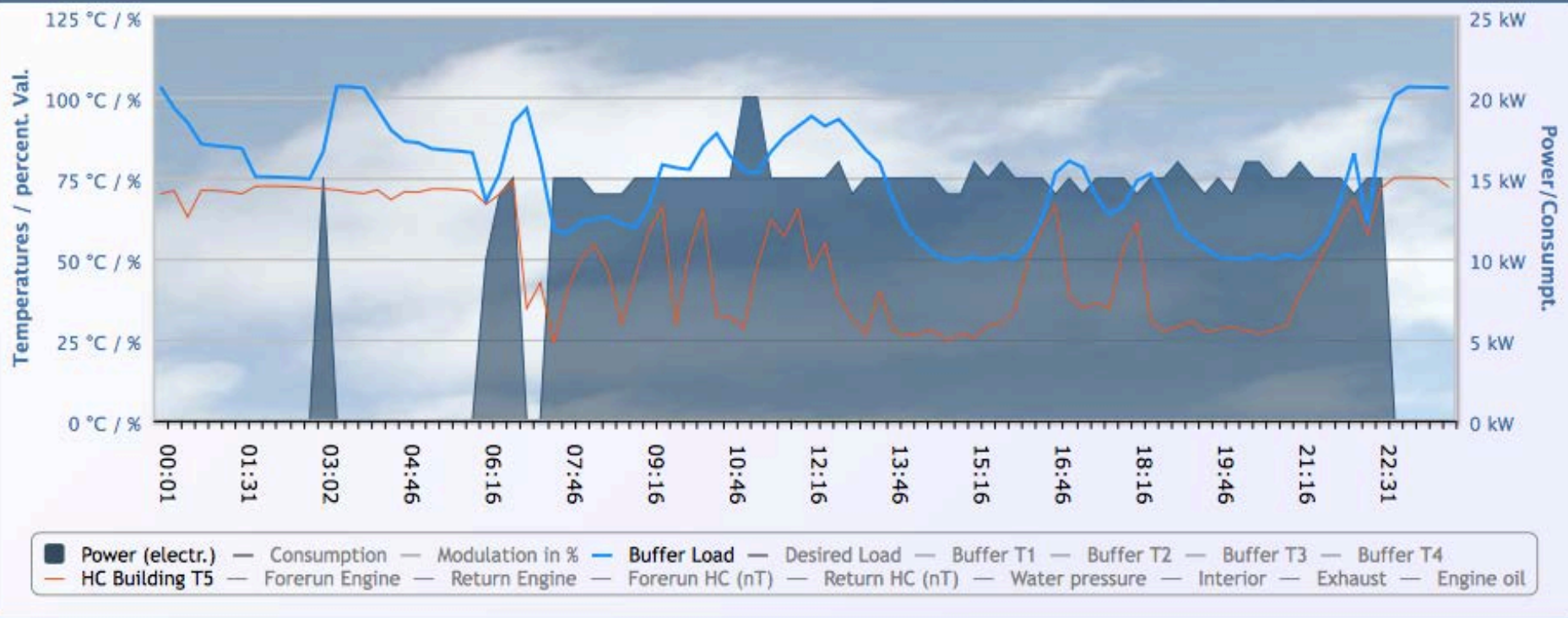
Thank You

Cynthia Regnier

Lawrence Berkeley National Laboratory

Getting Beyond Widgets: Developing Packaged Building Systems for Deeper Energy Savings

Better Buildings Alliance

Lawrence Berkeley National Laboratory
Energy Technologies Area

Integrated Systems – Realizing Deep Energy Savings

Numerous case studies show that integrated systems can result in deep energy savings…

Figure: Comparing Two Approaches of Component Level Equipment Replacement in a Whole Building Retrofit to a Whole Building Integrated System Approach [DRAFT - Regnier et al, 2016]
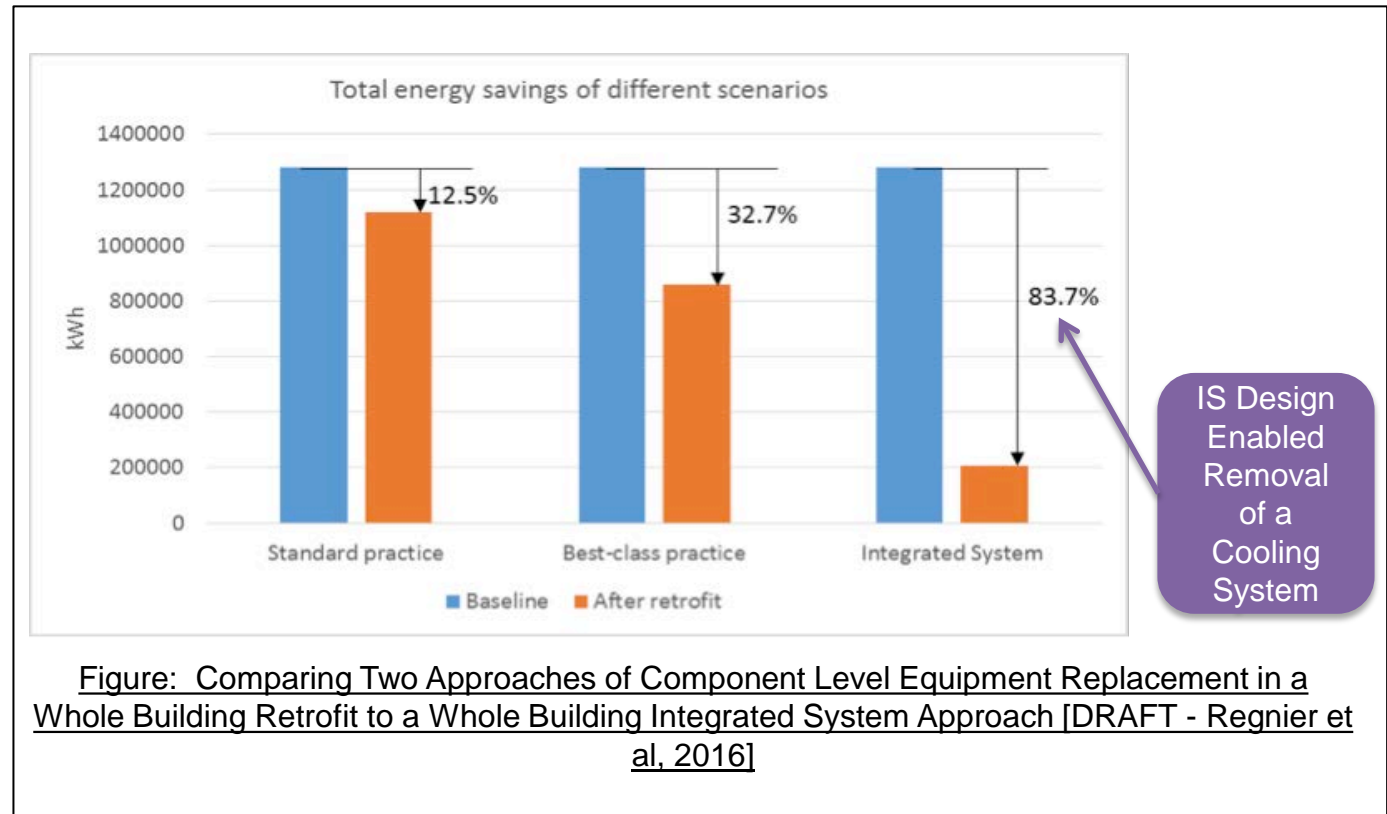
Component equipment replacements alone will not meet state and federal energy savings goals (e.g. CA 2030 net zero, 50% energy savings)

An integrated systems approach is needed

DOE-LBNL Project – Beyond Widgets, Systems Programs for Utilities and Owners

Goal: Develop validated Building <u>Systems</u> Packages for utility energy efficiency incentive programs

- Working with at least <u>3 utilities</u>, develop packages for at least <u>3 systems</u>

Building Systems Program Package
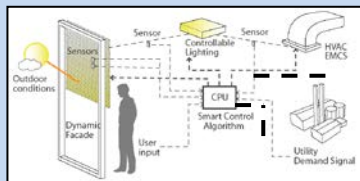
System specifications

Savings & performance metrics

M&V specifications

FLEXLAB-validated Savings

Controlled testing and validation of systems
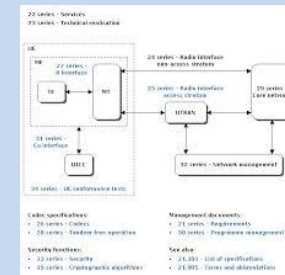
Savings persistence guidance

Assessment method and system implementation guidelines

Systems and Partner Utilities

	System	Market	Whole Building Potential Savings
ComEd An Exelon Company	Automated shading integrated with daylighting controls	Med-large office K-12 Educational	9-23%[1]
Xcel Energy℠	Daylight redirecting window film integrated with daylight dimming	Med-large office	17-33%[2]
NCPA NORTHERN CALIFORNIA POWER AGENCY **SCPPA**	Integrated task/ambient lighting with plug load occupancy-based controls	Small-large office	17-27%[3]

Notes:
1. Compared to DOE benchmark 1980s era building, with range of glazing VT and LPDs.
2. Compared to ASHRAE 90.1-2010 (CO) and ASHRAE 90.1-2013 (MN).
3. Compared to CEUS average small (17% result) and large (27%) commercial office baseline.

FLEXLAB – Facility for Low Energy eXperiments in Buildings

- LBNL developed FLEXLAB, DOE's unique facility dedicated to:

  - Developing & validating solutions for highly-efficient, **integrated building systems under realistic operating conditions**

  - Research focus includes:
    - Systems integration at end use, whole building & grid interaction levels
    - End use integration & component interactions (e.g., HVAC, lighting, windows, envelope, plug loads control systems)
    - Controls hardware & sensors
    - Simulation & tools for design through operations

- Commercial buildings focus, with applications relevant to office, retail, educational, multi-family

  - New construction & retrofit

- Energy efficiency studies, including thermal & visual comfort & occupant engagement

Automated Shading/Dimmable Lighting FLEXLAB Test (ComEd Partner)

Reference Room (XRA)   Test Room (XRB)

Automated Shading and Daylight Dimming System - FLEXLAB Test Setup

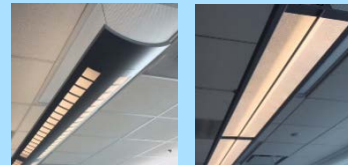## Multiple test configurations

Orientation
South, West

Daylight zone
10', 15', 25' depth

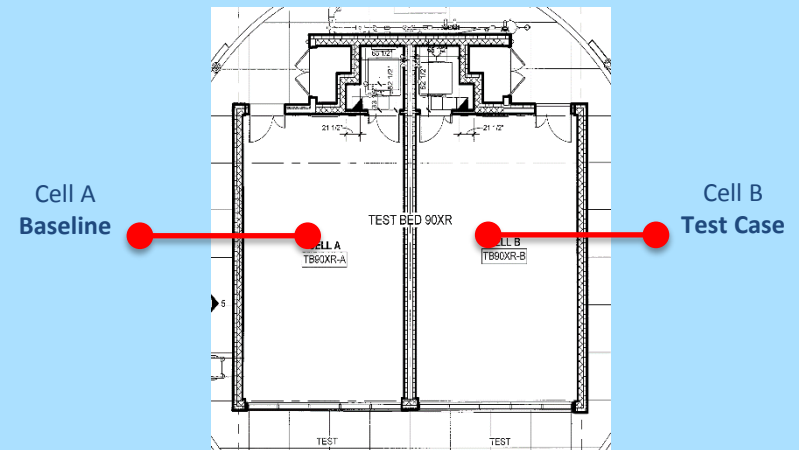movable walls to change zone depth

Window size
0.3, 0.4 window-wall ratio
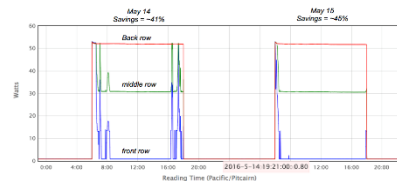

Lighting type
T-8, LED

Baseline Comparison

Cell A represents a baseline with venetian blinds and no dimming. All other system features and operations are identical, allowing for a true 'controlled' experiment.

Cell A
Baseline

Cell B
Test Case

Extensive Metering
allows for detailed analysis of each component and end use


Adjusting for Climate
Internal temperature setpoints are adjusted in real time to match the indoor-outdoor temperature difference in Chicago. This provides realistic estimates of HVAC loads for Chicago climate.

Automated Shading & Daylight Dimming Preliminary Results – First Rounds of Tests

6 configurations tested to date
Lighting energy savings: 40-45% south; 25-30% west
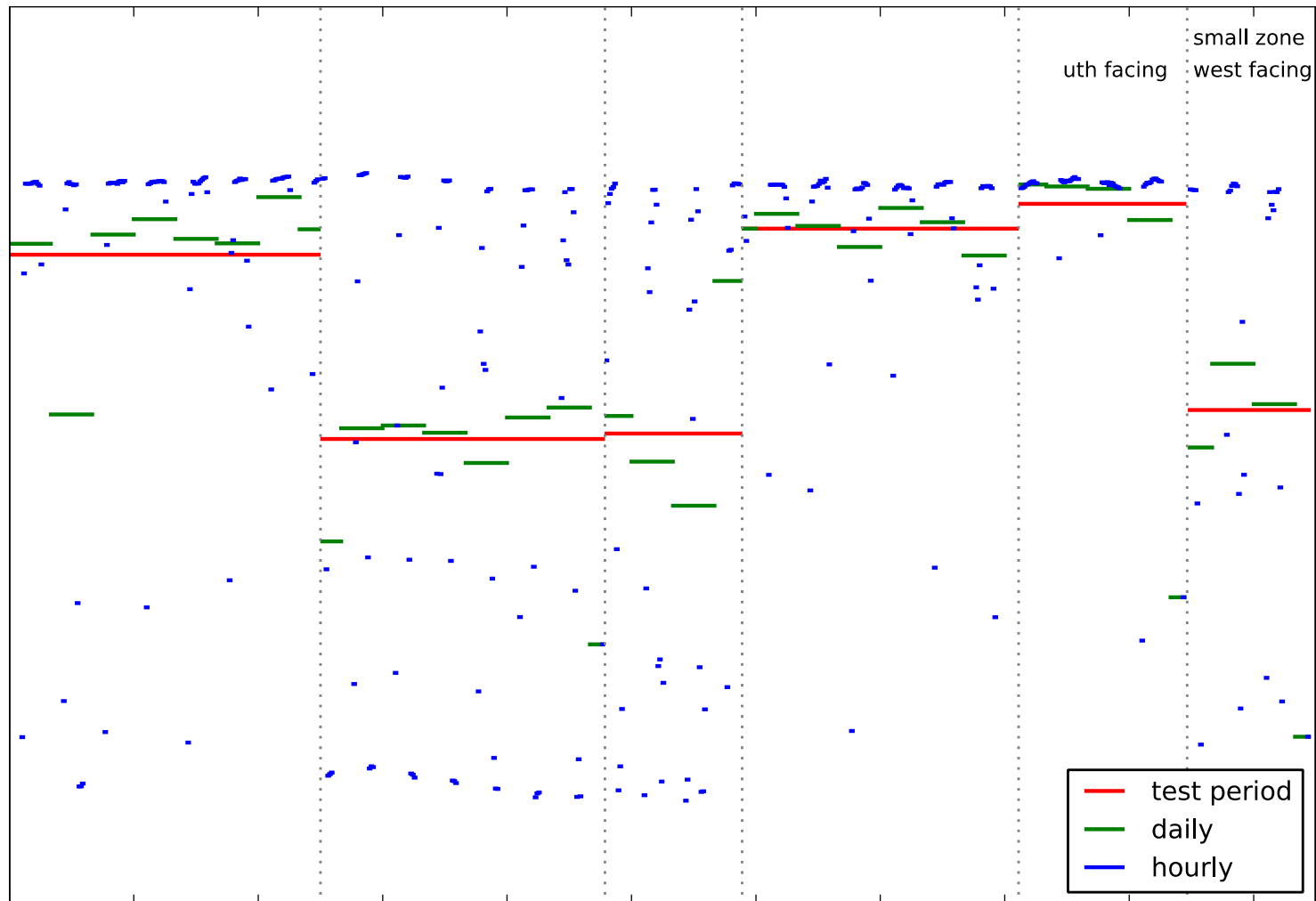
Task-Ambient Lighting and Plug Load Occupancy Controls (CA Public Owned Utilities Partners)

2 Technology Package approaches:

Package 1 - The plug-and-play nature of the overhead lighting retrofit does not trigger Title 24 Energy Code.

- Troffers or pendants, T8 to tuned linear LED replacement lamp for overhead; LED task lights
- Overhead lighting evaluated with and without existing scheduling and occupancy controls as well

Package 2 – Modifications or alterations trigger Title 24 Energy Code.

- Troffer or pendant replacement, T8 or T5 to LED with manual on/off, scheduling, occupancy controls, tuning and daylight dimming in perimeter
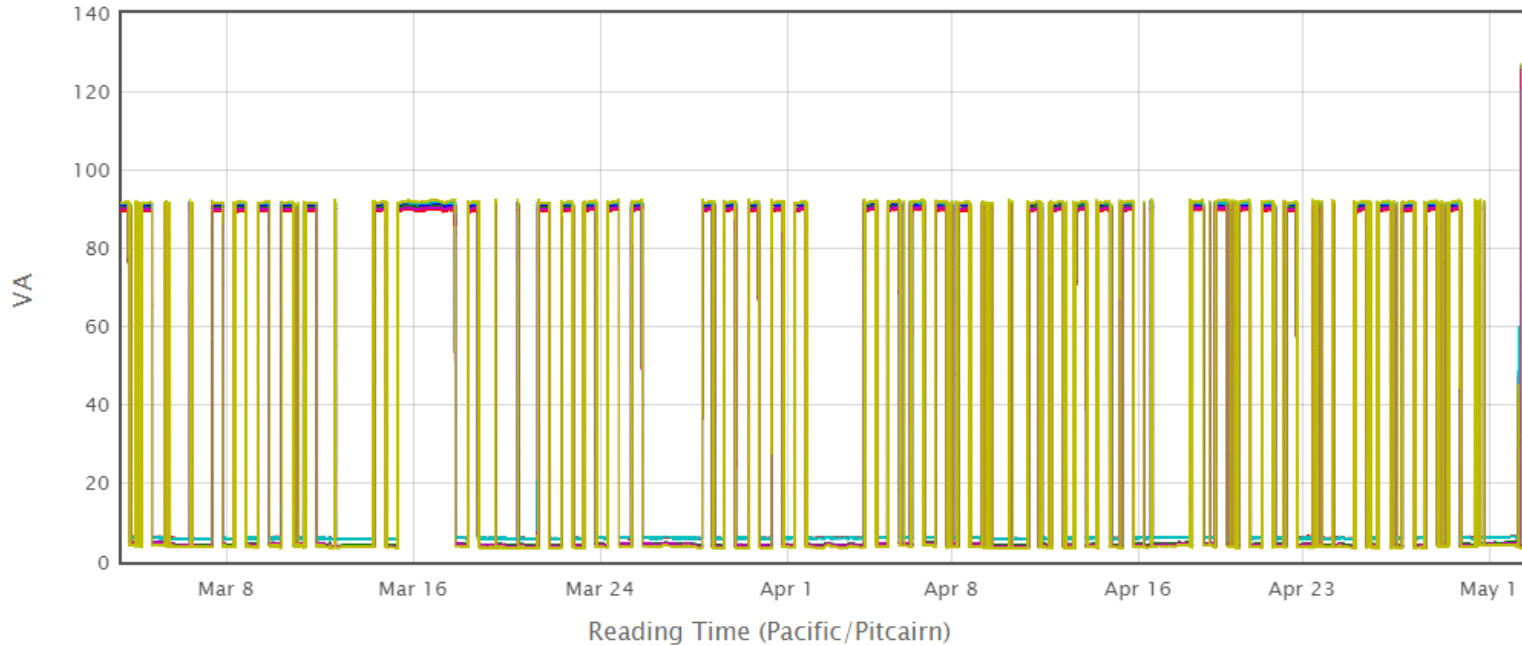

LED T8 replacement lamps

Plug load and task light occupancy controls options, applicable to either package:
- Programmed schedule only
- Programmed scheduling and occupancy sensor based controls

Representative technologies – Wattstopper, Autani, Telkonet

BERKELEY LAB
Lawrence Berkeley National Laboratory

Overhead Lighting Circuit Energy – Zonal Level Occupancy Control

		(kWh/sqft/yr)	(% savings over existing baseline)
Overhead Lighting Energy Savings		4.64	71%

31

BERKELEY LAB
Lawrence Berkeley National Laboratory

Package 2 - Preliminary Test Results – Plug Load Energy

Controlled Plug Load Circuit Energy – Workstation-level occupancy control

	(kWh/sqft/yr)	(% savings over existing baseline)
Plug Loads Energy Savings	0.48	10%
Total Overhead Lighting and Plug Load Energy Savings	5.12	46%

Next Steps

- Complete FLEXLAB testing (Sept – Dec 2016)

- Validate savings, assess M&V approaches, package test results, complete method and implementation guidance (Fall 2016 – Spring 2017)

- Training and tech support for utility program implementation (through Fall 2017)

System specifications, presentation and ACEEE paper on progress to date available at:

cbs.lbl.gov/beyond-widgets-for-utilities

FLEXLAB™: THE WORLD'S MOST ADVANCED BUILDING EFFICIENCY TEST BED

FLEXLAB CLOSES THE ENERGY-EFFICIENCY ACHIEVEMENT GAP FOR BUILDINGS

This facility could be the most important building in the country.

JES PEDERSEN
CEO, WEBCOR BUILDERS

Web: FLEXLAB.LBL.GOV   Twitter: @BerkeleyLabETA   #FLEXLAB

BERKELEY LAB
Lawrence Berkeley National Laboratory

Additional Resources

Engage: Better Buildings Alliance

>200 partner organizations   >11 billion sq. ft.

20% more efficient by 2020

| Commercial Real Estate | Food Service, Retail & Grocery | Healthcare | Hospitality | Higher Education |

Technology Solutions Teams

- Lighting
- Space Conditioning
- Plug & Process Loads
- Refrigeration
- Energy Information Systems
- Renewables Integration

Market Solutions Teams

- Financing Strategies
- Leasing and Tenant Engagement
- Training / Workforce
- Appraisals and Valuation
- Data Access

Better Buildings
U.S. DEPARTMENT OF ENERGY

U.S. DEPARTMENT OF ENERGY

Host: Techs looking for Buildings

Energy Management/Analytics

- Turnkey Controls and Analytics
- Guaranteed Performance for Analytics-Based Energy Savings
- Cloud-based Interoperable Building Analytics

Envelope

- Air Barriers: One-Step Sprayable Liquid Flashing and Primerless Self-Adhered Membrane

- Coming in 2017: R-5 Windows, Cold Climate Heat Pumps and Alternative Refrigerants

Better Buildings
U.S. DEPARTMENT OF ENERGY

U.S. DEPARTMENT OF
ENERGY

Participate: Smart Energy Analytics

- **Recruiting now** to encourage the use of Energy Management and Information Systems + submetering to achieve ongoing energy savings.

- Campaign participants receive **technical support and national recognition.**

- Guidance on getting started or improving your EMIS installation.

- Archive of short EMIS software demos

- Peer sharing for specific areas of interest: energy information, Fault Detection and Diagnostics, submetering

Join: smart-energy-analytics.org

Q & A

U.S. DEPARTMENT OF
ENERGY

Additional Questions? Please Contact Us

betterbuildingswebinars@ee.doe.gov

Today's Presenters	Amy Jiron U.S. Department of Energy Amy.Jiron@EE.Doe.Gov Kris Jorgensen A.O. Smith Corporation KJorgensen@aosmith.com	Cynthia Regnier Lawrence Berkeley National Lab cmregnier@lbl.gov
DOE Program Leads	Holly Carr DOE, Better Buildings Challenge Holly.Carr@EE.Doe.Gov	
Program Support	Kendall Sanderson JDM Associates ksanderson@jdmgmt.com	Holt Mountcastle JDM Associates hmountcastle@jdmgmt.com

Follow us on Twitter @BetterBldgsDOE