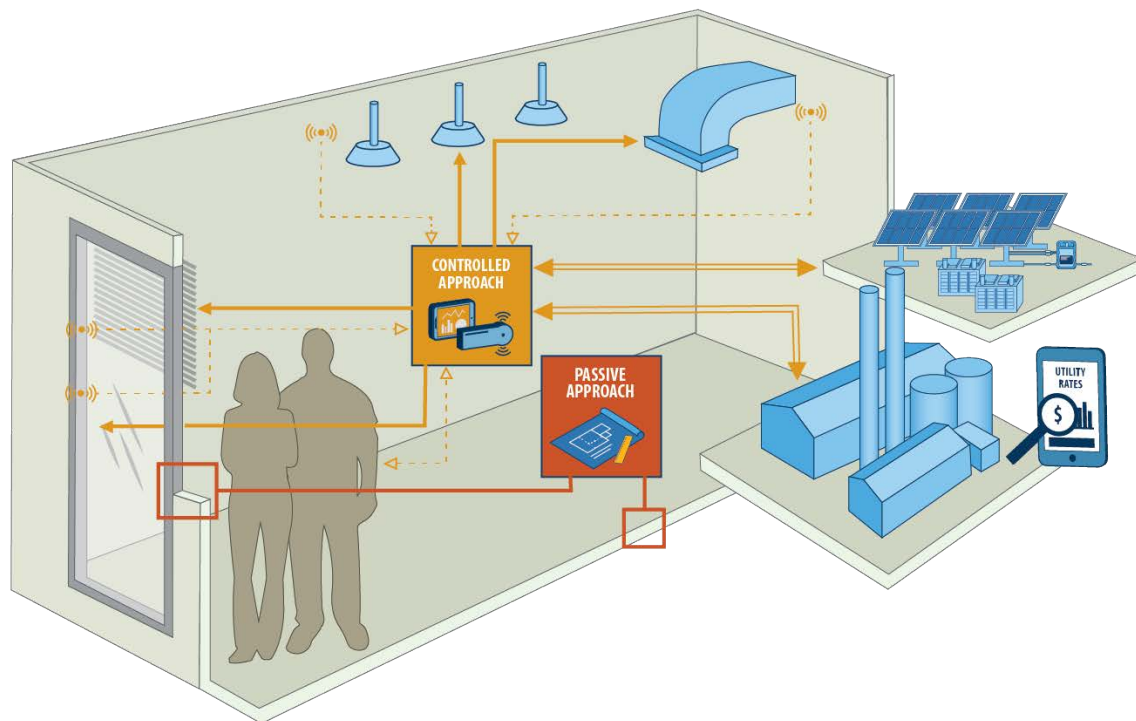


Getting Beyond Widgets – Integrated Systems for Commercial Buildings



LBNL

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Project Summary

Timeline:

Start date: Oct 1, 2014

Planned end date: Sept 30, 2018

Key Milestones

1. White paper with validated test results for all 3 systems and comparison with 'widget' approach; March 30, 2018
2. Completed Systems Scoping Study; June 30, 2018

Budget:

Total Project \$ to Date: \$2.6M

- DOE: \$2.1M
- Cost Share: \$500k (including in-kind)

Total Project \$: \$2.9M

- DOE: \$2.3M
- Cost Share: \$550k (including in-kind)

Key Partners:

ComEd	Energy Trust of Oregon
Xcel (CO, MN)	NYSERDA
SCE	PG&E
GSA	SMUD, etc.
FEMP	NAESCO

Project Outcome:

Three integrated systems with cost and energy evaluative comparisons to 'widget' based retrofits to quantify the value of system based retrofit approaches.

Scoping study to understand the current state of systems deployment in the market focusing on U.S. utility custom incentive programs, large scale retrofit programs (e.g. FEMP, GSA), and ESCOs. This study will inform future systems R&D to enable 30% + energy reductions for existing buildings.

Team



LBNL

- Systems development and validation, energy and cost analysis
- Developed 3 integrated systems for utility DSM program inclusion at FLEXLAB® – DOE’s integrated systems test facility
- Systems scoping study data collection, management and analysis



DSM Utilities:

- Partner on integrated systems DSM program development (ComEd, Xcel (CO/MN), California POUs)
- Systems scoping study participation – data and expertise (All)



GSA, FEMP and ESCO participants:

- Systems scoping study participation - Retrofit program data and expertise



Team

Systems Scoping Study Utilities:

- Systems scoping study participation – data and expertise



Implementation participants:

- Systems scoping study participation - expertise



Challenge

Problem: Integrated systems can provide 50%+ additional whole building energy savings in existing buildings (Regnier et al, 2017).

However, a number of barriers exist:

- Systems are inherently more complex and disruptive to implement
 - Utility portfolios currently set up for widget-based incentive programs
- There is a lack of industry awareness of how systems can provide deeper savings in contrast to ‘widget’ based upgrades (DNV GL, 2016)
- There is low awareness about the state of systems deployment through existing market channels, and the areas of systems R&D needed to gain deeper market penetration

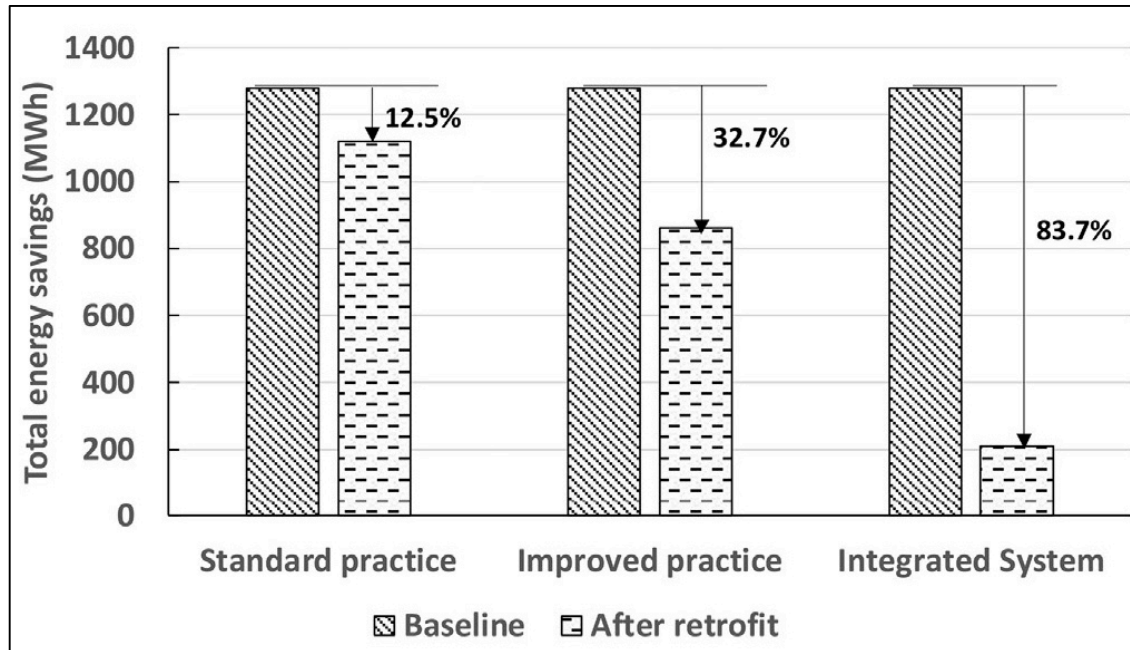
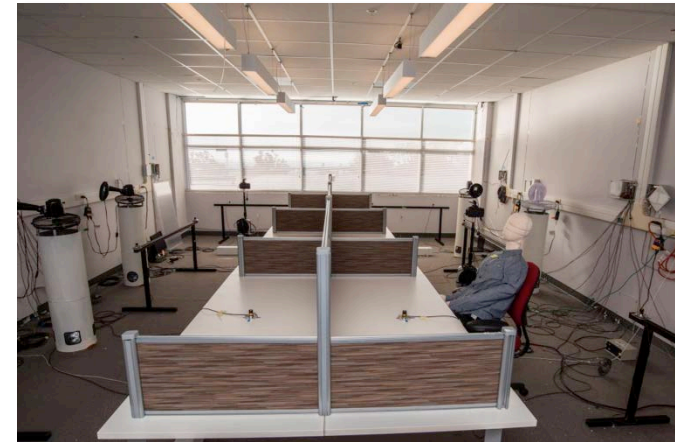


Figure – Regnier et al, Energy and Buildings, 2017

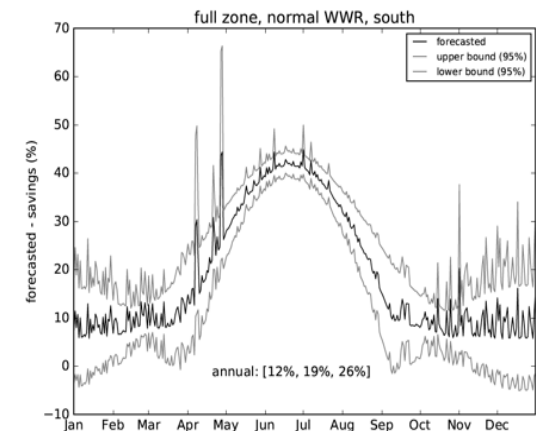
Approach Part 2– Quantifying Systems Savings vs Widgets

Conduct an evaluative comparison study for each system with an alternative ‘widget’ based retrofit.

- Normalize energy savings to a common baseline
- Identify standard practice equivalent ‘widget’ based retrofit
- Conduct energy and cost evaluations of annual energy savings potential
- Document and disseminate to stakeholders – e.g. ASE, Esource, CEE and utility programs



FLEXLAB Test - Workstation specific lighting system



Annualized automated shading and daylight dimming energy savings from FLEXLAB Testing

Approach Part 3 –

Identifying Systems Market Trends and Opportunities

- Collect market and project level data to understand current systems based retrofits – standard practice and exemplary
 - Utility custom incentive programs
 - These can address energy saving strategies ‘beyond the widget’
 - Large retrofit programs
 - FEMP
 - GSA – through ARRA funded projects, and Deep Energy Retrofit program
 - ESCOs
 - LBNL database of ESCO project level data for the National Association of Energy Service Company Organizations
 - Other data sources
 - Esource database – high level information across U.S. utility programs
 - Utility program evaluation studies, such as CALMAC utility program evaluation database



E Source

Approach Part 3 – Identifying Systems Market Trends and Opportunities

- **Collect market data relevant to examples of *high performance buildings* to assess systems strategies present**
 - DOE High Performance Database
 - NBI Zero Net Energy Database
 - AIA COTE Winners
- **Categorize and analyze data to assess:**
 - Technologies employed
 - Systems level strategies used
 - Correlation to project level energy savings
- **Conduct interviews with stakeholders on systems technologies of interest, perceived barriers**
 - Identify system strategies of strategic interest to their customers, to the evolving utility energy landscape (GEB)
 - Include implementers, owners, utility program managers, other stakeholders
- **Document findings in scoping study report**

nbi new buildings
institute



U.S. DEPARTMENT OF
ENERGY



Impact – Developed Integrated Systems Packages

BTO program goals include reducing existing buildings EUI by 30% by 2025. Three integrated systems packages validate significant annual energy savings ([cbs.lbl.gov/beyond-widgets-for-utilities](https://www.cbs.lbl.gov/beyond-widgets-for-utilities))



Workstation specific lighting with daylight dimming

- 82% lighting savings
- 6-15% whole building savings (med – large office)



Impact – Developed Integrated Systems Packages

Task/ambient lighting combined with plug load occupancy controls

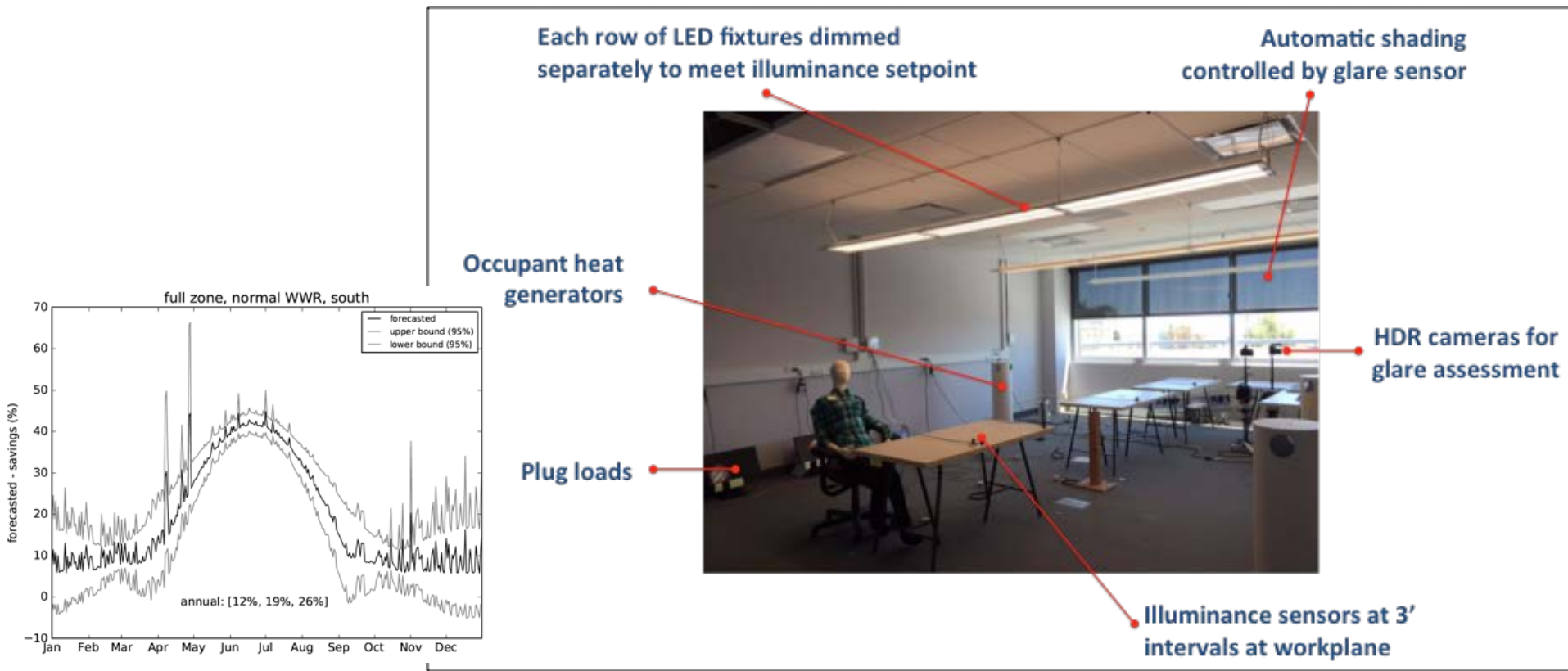
- 30-41% lighting and plug load savings (office)
- 12-20% whole building savings (small – large office)



Impact – Developed Integrated Systems Packages

Automated shading combined with daylight dimming
(excludes fixture upgrade)

- 36% lighting savings (office), 30% lighting savings (school)
- 5-9% whole building savings (office, school)



Impact – Developed Integrated Systems Packages

- Three system packages deployed to three sets of utility partners for development into streamlined incentive programs



- California POUs have executed the task/ambient lighting system into their Technical Reference Manual -> Enables efficient deemed approach to systems implementation
- Xcel is piloting through their new construction program
- **Utility custom incentive programs represent a substantial energy reduction deployment path. Per Esource, existing custom incentive programs saved 3,272 GWh last year – enabling streamlined systems deployment enables greater reach to customers**

Progress – Systems vs Component Comparison

- Systems white paper draft completed, in review (late stage)
- Technical evaluation demonstrates *systems provide substantial increased energy savings, 50-70%+ additional savings over a widget based approach*

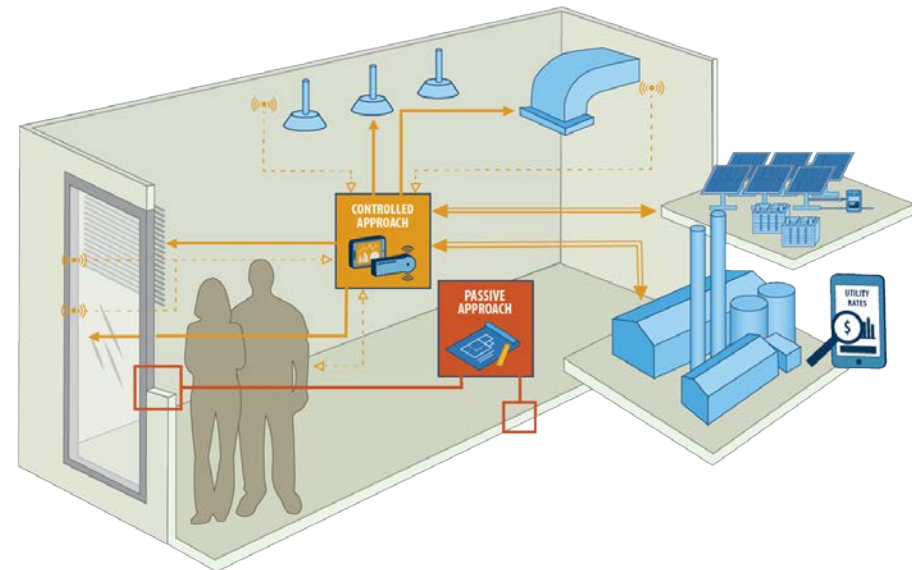
Option	Lighting EUI (kWh/sf/yr)	Lighting Savings	
		Relative to Baseline	Relative to Component- Based Retrofit
Baseline (Fluorescent, scheduled control)	3.68	–	–
Component-based Retrofit (simple LED)	1.36	63%	–
Automated Shading and Daylighting	0.64	83%	53%
Workstation-Specific and Daylighting	0.31	92%	77%
Task / Ambient and Occupancy	0.67	82%	51%

Next steps:

- Complete cost evaluative analysis including life cycle economics
- Publish and disseminate through industry channels

Progress – Systems Scoping Study (mid stage)

- Data collected from multiple large retrofit program sources
 - GSA, FEMP, NAESCO
- Utilities are requiring Non Disclosure Agreements in many cases
 - Developed data management and protection plan
 - NDAs in progress
- Sourced high performance retrofit projects for comparison review
 - DOE's High Performance Database
 - NBI Zero Net Energy project database
- Drafted data review strategy
 - Definitions of end use, interactive and integrated systems retrofits
 - Draft framework for project level data review to identify systems implementation



Stakeholder Engagement

Integrated Systems Deployment

- Esource Forum
- Collaborating on FEMP/BBA Energy Exchange panel
- ACEEE Summer Study on Energy Efficiency

Systems Scoping Study

- Engaged many utilities for study participation – some have had to drop out as their regulators do not permit data sharing
- Contacts with multiple implementer firms (TRC, CleaResult, DNV GL, etc.)
- Promotion of study through CEE, ESource
- Coordination with ASE on future dissemination activities

Remaining Project Work

Systems Comparison White Paper

- Receive comments and update (May 2018)
- Update project website, publish (June 2018)
- Dissemination through industry channels (ASE, Esource, FEMP Energy Exchange/ Better Buildings Summit, etc.)



Systems Scoping Study

- Complete utility NDA execution and collect data
- Conduct data driven evaluation of best practice retrofits, identifying systems implemented, frequency, climatic distribution, correlation with energy savings
- Conduct stakeholder interviews
- Document findings and disseminate through industry channels
- Use by DOE to inform future systems R&D

Thank You

LBL

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REFERENCE SLIDES

Project Budget

Project Budget: Commenced in FY14, ~2.2M budget to date.

Variances: N/A

Cost to Date: ~2.1M expended to date.

Additional Funding: N/A

Budget History

FY14– FY 2017 (past)		FY 2018 (current)		FY 2019 – TBD (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
1,900k	450k	374k	100k	TBD	TBD

Project Plan & Schedule

- Project started Oct. 1, 2014, completion projected Sept. 30, 2018
- FY18 schedule: Complete and publish component vs systems analysis. Complete systems scoping study and disseminate.
- Go/no-go confirmation base on results of component vs system analysis.
- Future work includes identification of additional systems of interest, test and develop into program packages.

Project Schedule							
Project Start: Oct 1, 2014	Completed Work						
Projected End: Sept 30, 2018	Active Task (in progress work)						
	◆ Milestone/Deliverable (Originally)						
	◆ Milestone/Deliverable (Actual)						
	FY2017			FY2018			
Task	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	
Past Work							
Q4 Milestone: Final system packages with program manuals			◆				
Current/Future Work							
Q1 Milestone: Final system 3 package with test results			◆				
Q2 Go/no-go: Analysis and paper of component vs systems based retrofits.				◆			
Q3 Milestone: Scoping Study Analysis and Package Recommendation Report						◆	