U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Integrated Systems Packages Optimized for the Real Estate Lifecycle

New Project

LBNL
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Project Summary

Timeline:

Start date: Oct 2018 **[NEW project]**

Planned end date: Sep 2021

Key Milestones

- Design and specification of Integrated System Packages (ISPs). 6-30-2019
- FLEXLAB testing of ISPs. 3-31-2020
- Field validation of ISPs in CBRE buildings. 6-30-2021

Budget:

Total Project $ to Date:

- DOE: $825,000 (FY19)
- Cost Share: $0 (in-kind)

Total Project $:

- DOE: $2,731,000 (FY19-21)
- Cost Share: $600,000 (planned in-kind)

Key Partners:

CBRE	*Advisory Committee:* ComEd, EDF, Emcor, Gensler, NYSERDA, PG&E, Paypal, Therma, TRC, ULI
kW Engineering	
Rocky Mountain Inst.	

Project Outcome:

This project aims to enable scaled adoption of deep energy savings retrofits by: a) creating standardized integrated systems packages that reduce “hassle” and transaction costs; and b) embedding them within routine real-estate events. The ISPs can in effect make integrated systems the low-risk ‘default’ option for routine real-estate life cycle events such as renovation, lease fit out, and equipment replacement.

This project supports BTO CBI MYPP strategies #1,2

Team


P. Mathew


P. Coleman


C. Regnier


J. Page


J. Shackelford


D. Kubischta


P. Pollard


D. Jump


G. Hopkins


M. Jungclaus


V. Olgyay


M. Groppi

LBNL **leads the overall project** and will conduct the **FLEXLAB testing** of integrated systems packages (ISPs). LBNL has over 30 years experience in the research, development, and validation of energy efficiency technologies and strategies.

kW Engineering will lead **engineering development** and advise **field commissioning and M&V** of ISPs, drawing on their expertise in designing and implementing energy efficiency solutions for commercial buildings.

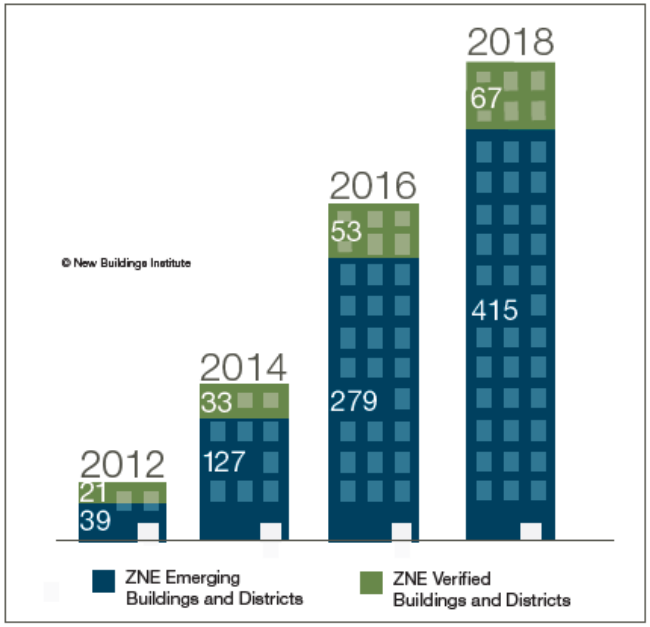
Rocky Mountain Institute will help with **stakeholder engagement**, drawing on their expertise in accelerating the adoption of market-based solutions that cost-effectively advance energy efficiency and renewables.

CBRE's Global Energy & Sustainability team delivers energy and sustainability solutions for CBRE clients. They will **support implementation of ISPs at CBRE sites**.

DOE Managers: Ken Sandler, Cindy Zhu

The Challenge

Integrated systems technologies can deliver deep energy savings…



Almost 500 zero-net-energy buildings!
Source: New Buildings Institute

...but:

- retrofits are often **too disruptive** because they are **not aligned with the real estate life-cycle**;
- require **significant engineering expertise** to implement and operate,
- utility incentives often entail **overly cumbersome M&V**;
- lingering concerns with **savings uncertainty and persistence**.

It's not easy to implement deep retrofits → ***Hinders scale adoption needed to meet BTO goals***

Approach: Proposed Solution

Develop and field-validate a scalable approach to achieve deeper building energy savings in existing buildings. Two key elements:

1. **Integrated systems packages** (ISPs) that reduce transaction costs through technology packaging, standardization and streamlining.
2. Embed ISPs in routine **real estate life cycle events**, to reduce disruption and increase cost-effectiveness.

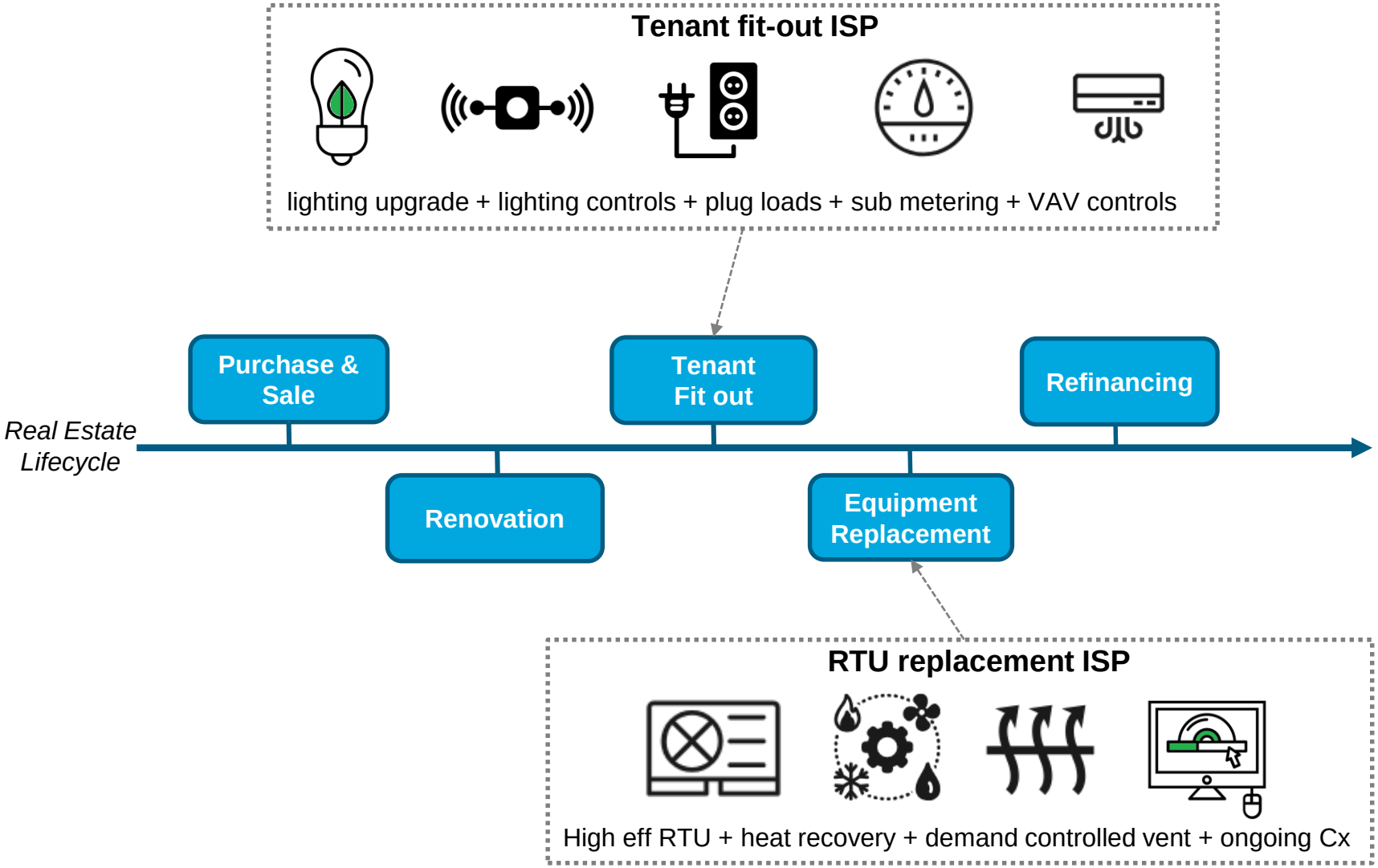
This effort complements BTO LBNL ”Beyond Widgets” project by:

- tailoring packages to real estate lifecycle events;
- field-validating in real buildings.

Vision:

Integrated systems with deep savings become the low-risk ‘default’ option for routine real-estate life cycle events

ISPs: Illustrative examples



Approach: Method

Develop Integrated Systems Packages

Characterize real-estate life cycle events

Design and specify technology packages

Conduct FLEXLAB® Testing

Conduct Field Validation

Suite of validated Integrated System Packages (ISPs) for real estate life-cycle events

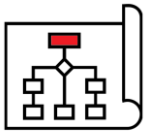
- ...
- Whole Building Renovation ISP
- Tenant space fit-out ISP
- RTU Replacement ISP
- ...

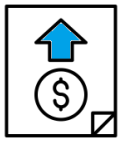
Technology Transition

- Utility Programs
- Owners Managers
- Designers
- Service Providers/ Vendors
- Investors Lenders

Approach: Expected Outputs & Audience

1 *Resource sets for design and delivery chain*


Applicability guides


Benefit-cost calculators


functional test protocols


Installation requirements


operational guidelines

2 *Laboratory and field validation results*


Energy performance


Cost-benefit


Transaction costs

Key audiences:

- **Building owners/managers and tenants**
  - Develop scope of work and procure products/services for real estate events.
- **Design professionals, service providers, vendors**
  - Offer value-added “upsell” offerings to building owners and operators.
  - Ease the sales cycle and reduce customer acquisition costs.
- **Efficiency programs**
  - Offer incentives based on field validation results.
  - Reduce the level of effort to deploy these technologies via custom incentive programs.

Impact: Stock analysis

- Stock analysis using BTO SCOUT tool
- Technical potential assumes ISPs with 20% savings
- Two adoption scenarios: 10%, 30%

Sector	Annual energy use baseline TBtu	Annual savings tech. potential TBtu	Annual savings (10% adoption) TBtu	Annual savings (30% adoption) TBtu
Large Office	1400	280	28	84
Small Office	807	161	16	48
Total	2207	441	44	132

Enabling scale adoption of integrated systems routinely in the real estate life-cycle → ***Savings depth x breadth***

Progress to date

Note: This is a new project, started Oct 2018

Characterize real estate events	• 33 stakeholder discussions completed • Synthesized themes and takeaways for ISPs – draft report completed
ISP design and specification	• 2 design charrettes conducted - reviewed 36 candidate measures for ISPs • Developed outline for package elements
Technical advisory committee	• Constituted TAC with 11 members • Conducted first TAC meeting

33 Stakeholder Discussions

- *Operators*
- *Owners*
- *Tenants*
- *Investors*
- *Developers*
- *A/E*
- *Construction*
- *Lease lawyers*

- Two large real estate investment firms
- Two well known tech firms
- Large bank
- Large asset management firm

Stakeholder Perspectives: Key Themes

Payback is (almost always) still important
3-5 years "if you're lucky"
Can be overridden with other benefits

Packaging and standardization are valuable
Reduction in time, hassle, and risk
What's proven and easy gets done

Lease and ownership structure (and term) matter
Who pays for energy?
What's the "hold period"?

Organizational priorities and practices vary widely
Even within the same organization

Get in the specs
templates, portals, standards, …

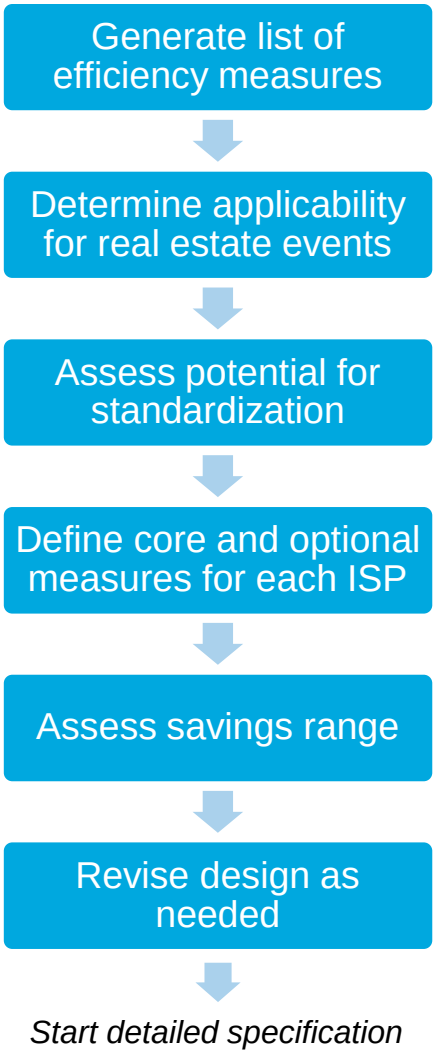
Timing matters
"there a 3-4 week window…"

The key influencer is … not obvious

Key Takeaways for ISP Development

➢ **Provide context-specific guidance to select packages**	*With easy-to-use tools (e.g., flow charts) that cover systems, lease structure, etc.*
➢ **Modularize packages**	*Allow for building-specific characteristics and broaden their applicability*
➢ **Calculate cost effectiveness with user-relevant cost baselines**	*Based on incremental savings and costs for particular real estate event*
➢ **Articulate the value of non-energy benefits**	*Substantively and preferably quantitatively*
➢ **Make it easy across the whole delivery chain**	*Comprehensive set of resources for selection, specification, procurement, installation, commissioning, operations*
➢ **Be technology-agnostic**	*Most stakeholders don't have favorites; proveness, cost effectiveness and ease of implementation are more important criteria.*

ISP design process



	Tenant Fit Out Limited	Tenant Fit Out Expanded	Whole Building Renovation	RTU replacement
Lighting Lamp replacement	X	X	X	
Lighting fixture replacement	X	X	X	
Lighting occ controls	X	X	X	
Lighting daylight controls	X	X	X	
Lighting: Networked Lighting Control Sy	X	X	X	
Automated Interior shades	X	X	X	
Exterior shades			X	
Window films			X	X
Secondary Window inserts			X	
Window glazing upgrade			X	
Cool roofs			X	X
Plug load controls		X	X	
RTU upgrade			X	X
RTU upgrade w/ enthalpy recovery			X	X
RTU heat pumps			X	X
VRF RTU heat pump			X	X
VRF RTU heat pump w/ heat recovery			X	X
RTU w/ indirect evap cooling			X	X
VAV min reset	X	X	X	X
Thermafusers		X	X	
Rezoning		X	X	
DCV w/ CO2		X	X	X
DCV w/ occupancy	X	X	X	X
Intermittent ventilation	X	X	X	X
Ceiling fans w/ set point reset		X	X	
RCx incl ASHRAE guideline 36	X	X	X	X
Model predictive control			X	X
Heatpump DHW			X	
Instantaneous DHW			X	
Submetering	X	X	X	
Monitoring based Cx	X		X	X

Technical Advisory Committee

David Briefel, Gensler
Andy Bruch, EMCOR
Chris Corcoran, NYSERDA
Noel Corral, ComEd
Al Gaspari, PG&E
Jaxon Love, PayPal
Emily McLaughlin, ULI
Bruce Murdock, Therma
Gwelen Paliaga, TRC
Dipal Patel, CBRE
Marc Rausch, EDF

Initial meeting in February 2019 showed *strong engagement* by TAC members.

Next TAC meeting slated for late June 2019 to review ISP testing ideas.

Remaining Project Work

IN PROGRESS: Design of integrated systems packages (ISPs) optimized for specific real estate events
STARTING JUNE 2019: Conduct FLEXLAB testing of ISPs to assess energy performance, indoor environmental quality, commissioning and operating procedures.

PLANNED for 2020: Begin field-validation of ISPs to assess energy performance, cost effectiveness and transaction costs in actual real estate events in real buildings.
PLANNED for 2021: Complete field validation and develop a technology transition plan for future market uptake through multiple real estate stakeholder channels.

Task	FY19				FY20				FY21			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1												
Task 1.1 Characterize RE events												
Task 1.2 Design and Specify ISPs												
Task 2 FLEXLAB testing												
Task 3 Field evaluations												
Task 3.1 Site screening, down-selection												
Task 3.2 Planning and implementation												
Task 3.3 Evaluation												
Task 4 Technology Transition												
Task 5 External Review and validation												

Thank You

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Sponsor:

Research Team:

Demonstration partner:

REFERENCE SLIDES

Project Budget

Project Budget: $2,731,000 (FY19-21) of which $825,000 received (FY19)
Variances: None

Cost to Date:

- $125,442 expended to Feb 28, 2019.
- $229,023 encumbered in subcontracts FY2019

Additional Funding: $600,000 cost share (in-kind over the full project)

Budget History

FY 2018 (past)		FY 2019 (current)		FY 2020 – FY2021 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
N/A	N/A	$825,000	0	$1,906,000	600,000

Project Plan and Schedule

Project is underway and on schedule:

- Project began October 2018, with a planned completion date of September 2021