



ACEEE 2015 National Symposium on Market Transformation

Program Strategies Track C4:

Beyond the 5%: Solutions for Small and Medium Commercial Retrofits
Wednesday 22 April, 3:00 pm to 4:30 pm

Moderator: Mark Stutman, Penn State Consortium for Building Energy
Innovation

Speakers: Benjamin Rivers, National Grid
Nicole Carpenter, Vermont Energy Investment Corporation
Dennis O'Connor, United Illuminating



C4: Designing Programs that Engage Small and Medium Business Customers

- Commercial buildings that are less than 50,000 square feet represent just over half of the commercial floor space (not including malls). Utilities and contractors are both stepping up efforts to address the efficiency needs of this sector.
- This large volume of the commercial building market often has higher energy use due to factors such as reduced capital investment in improvements, lack of owner focus on physical building upgrades, and absence of targeted energy efficiency program offerings.
- This session will share strategies that are actively being used to improve efficiency retrofits for the small and medium commercial building industry, including program design approaches, targeted end measures, innovative incentive structures, and financing mechanisms.

Discussion Questions

1. Why is that small and medium commercial building market so critical to meeting portfolio efficiency targets?
2. *What are the key challenges necessary to overcome in order to achieve wide scale savings across this market?*
3. What are the primary barriers to date, and what program delivery approaches are successfully overcoming these challenges?
4. *How do you market to these owners and decision makers?*
5. Which efficiency measures are most relevant and readily adopted for smaller and medium-sized commercial buildings?



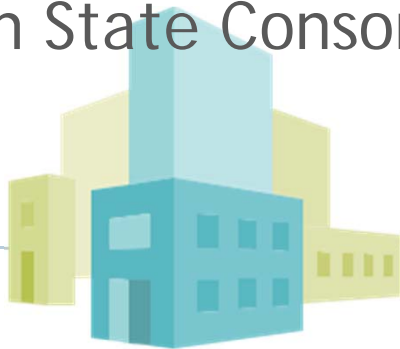
ACEEE 2015 National Symposium on Market Transformation

C4: Beyond the 5%: Solutions for Small and Medium
Commercial Retrofits

Wednesday 22 April, 3:00 pm to 4:30 pm

Mark B. Stutman, M.S., CEM, LEED AP O&M
Demonstration Program Manager

Penn State Consortium for Building Energy Innovation (CBEI)



Vision:

By 2030, deep energy retrofits that reduce energy use by 50% in existing SMSCB, which are less than 250,000 sq ft

Mission:

Develop, demonstrate and deploy technology systems and market pathways that permit early progress (20-30% energy use reductions) in Small and Medium Sized Commercial Buildings



Our Goals:

- Enable deep energy retrofits in small to medium sized commercial buildings
- Demonstrate energy efficient systems tailored for SMSCBs in occupied buildings – living labs
- Develop effective market pathways for energy efficiency with utilities and other commercial stakeholders: brokers, finance, service providers.
- Provide analytical tools to link state and local policies with utility efficiency programs

CBEI Partners



Industry



Economic Development Organizations



Universities

Summary / Outline

- Q1. Why is that small and medium commercial building market so critical to meeting portfolio efficiency targets?
- Q4. How do you market to these owners and decision makers?
- CBEI's Approach to energy retrofits in the SMSCB market, and some Findings to date

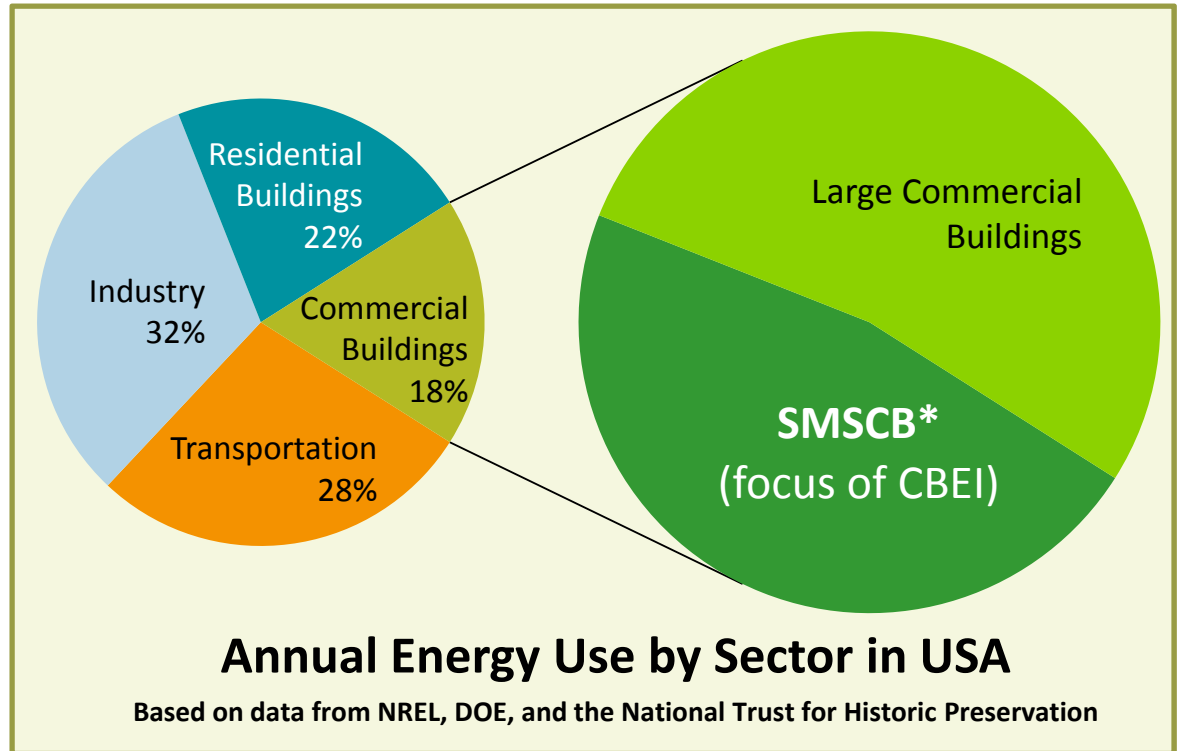


Why is that small and medium commercial building market so critical to meeting portfolio efficiency targets?



Why is the small and medium commercial building market so critical to meeting portfolio efficiency targets?

- Reducing building energy use is a national priority (EPA Act 2005)
- Despite ~50% improvement in equipment efficiency (since 1970s), building energy use has only declined by 15%
- Challenge: SMSCB* are diffuse (>95% of comm. bldgs.), ~half (>47%) of commercial building energy consumption, and has received little attention

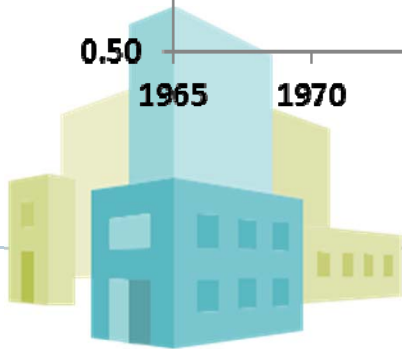
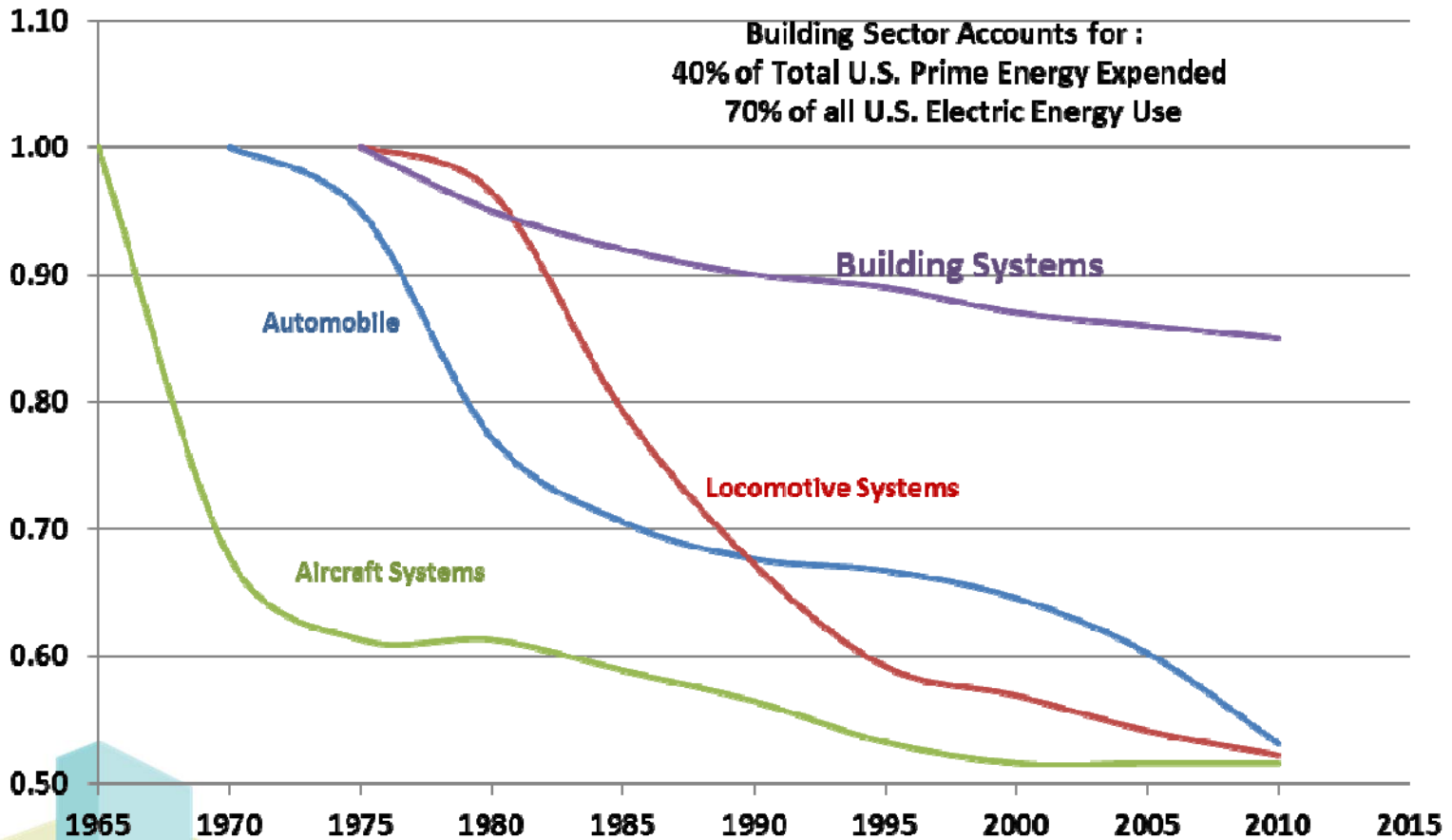


*Small and Medium Sized Commercial Buildings (less than 250k square feet)



Building Sector vs. Other Sectors

SFC
Fractional Improvement



How do you market to these owners and decision makers?



SMSCB Building Owners Told Us...

- Seek to understand the building from the Building Owner's (BO) point-of-view
 - Valued Asset or ... Not?
 - Financial Metrics
 - Asset Management Plan
- Don't just sell... act as an advocate for the BO for all his/her building's needs
- Leverage successful projects
- Guarantee/warrant savings and provide follow-up documentation of savings
- Address historic/regional nature of building stock



How do you market to these owners and decision makers?

- Leverage ‘Specifying Triggers’
- ‘Phased’ Asset Management Plans ‘on the shelf’
- Installers and Small Contractors
 - Sell What the Client Values
 - Build Trust with Client
 - Leverage Network of Trade Allies
 - Well Documented Solutions



Deep Energy Retrofit Triggers

- Adaptive reuse or market positioning
- (Near) end-of-life roof, window, or siding replacement
- (Near) end-of-life HVAC, lighting, major equipment
- Upgrades to meet code
- New Acquisition or Refinancing
- Fixing an “Energy Hog”
- Major Occupancy Change
- Energy Management Planning for Portfolio of Buildings

Source: Rocky Mountain Institute, Retrofit Depot
http://www.rmi.org/retrofit_depot_101_specifying_triggers

A Word on Selling Efficiency to SMSCBs

- Keep it short
- Skip connecting energy-efficient products to environmental concerns
- Sell the value of efficiency that resonates with prospect's segment, industry, organization and role within their organization
- Reframe energy efficiency solutions as an amenity that gets prospects more of what they know they want
 - occupancy, comfort, productivity, yield, higher foot traffic, higher sales, etc.
- Brief financial analysis should speak language of client
 - consider expanded style of life-cycle-cost analysis that better quantifies financial benefits
- Follow-up to confirm savings, present savings, discover any unexpected benefits, build more leads.

Source: Jewell & Christenson, [Selling Energy: Inspiring Ideas That Get More Projects Approved!](#), 2014.

CBEI's Approach to increasing energy retrofits in the SMSCB market



The CBEI Approach

- Develop cost-effective packages of technology solutions that have demonstrated energy savings
- Adapt solutions to the technical level of SMSCB owners and service providers who are engaged in planning and execution of demonstration efforts
- Engage with key stakeholders (retrofit industry, building owners, tenants, utilities, cities, regulators) in non-ideal settings
- Integrate workforce considerations: skills and training models



Partial List of CBEI Findings

RETROFIT MEASURES

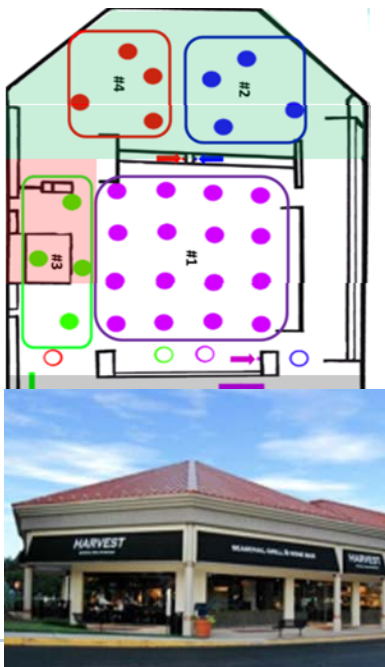
- Advanced Supervisory Control and Building 101
- Distributed RTU Controls
- AHU Automated Fault Detection and Diagnostics
- RTU Automated Fault Detection and Diagnostics
- Standardized Wall Retrofit System
- HVAC Retrofit Solutions

TOOLS & TECHNIQUES

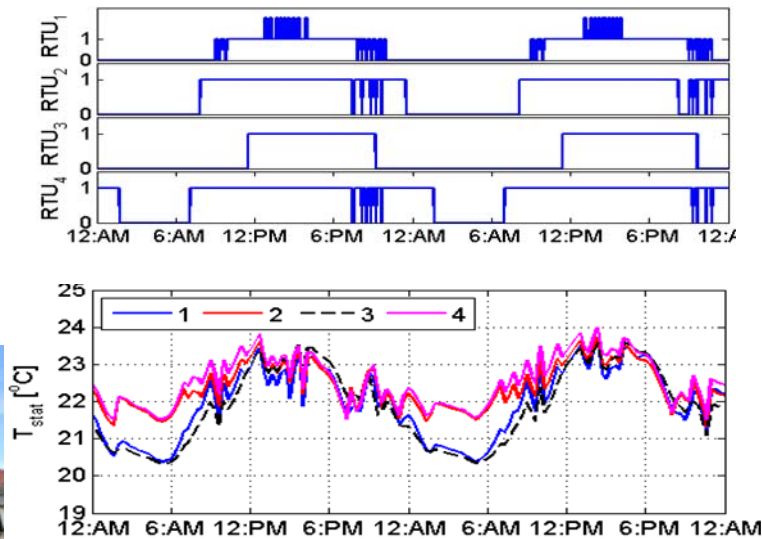
- Benchmarking, Disclosure, Training, and Market Transparency
- Building Energy Retrofits and Asset Management Planning
- Occupancy Evaluation and IAQ Assessment
- Building 661 Integrative Design Process

Distributed RTU Controls

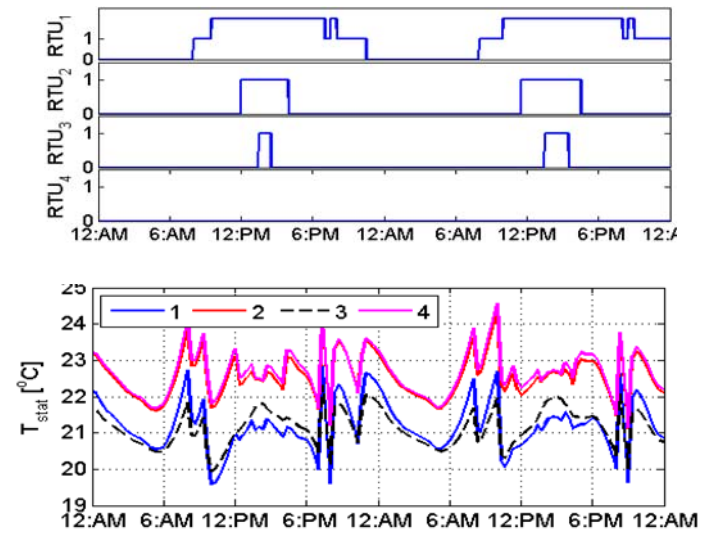
- Multiple RTUs serving the same space operate inefficiently
 - simultaneously heating and cooling
- Field demonstration of a predictive control algorithm
 - wireless thermostats networked together
 - Multiple RTUs coordinated
- Optimization algorithm controls RTUs for efficient operation
 - RTU power reduced ~22%; comfort improved
- Scaling via national facilities management and maintenance company



Independently Controlled RTU Performance



Web Enabled Optimized RTU Performance



Source: CBEI Finding - Distributed RTU Controls for a Strip Center Restaurant

Integrated Design Advanced Energy Retrofit Roadmap



Dr. Franca Trubiano, Kristen Albee
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Integrated Design Retrofit Roadmap Project Introduction

The market lacks process based products which can offer the architecture, engineering, and construction (AEC) industry a comprehensive action plan for completing Integrated Design (ID) advanced energy retrofits (AERs) in small to medium-sized buildings. This project is aimed at producing a set of step by step guidelines and protocols that organizes the actual design and construction process needed during an ID AER project. The Roadmap addresses integrated strategies for coordinating the full range of AEC services required. The ID AER Roadmap offers a three-tiered document suite.



ID AER Roadmap Overview

The Overview is an introduction brochure to the document suite that outlines the basic concepts of Integrated Design (ID) and Advanced Energy Retrofits (AERs). A short quiz helps identify what scale of retrofit may be appropriate for the project.



ID AER Roadmap Reference Manual

The Reference Manual focuses on all info related to the execution of an ID AER project. This document is geared towards building owners, AEC professionals, and tenants with limited knowledge of ID, AERs, and/or buildings.



Integrated Design Process Diagram – Partial Retrofits

PROJECT TEAM GUIDE: LITE

Details the implementation of an ID process for a project scope that includes the Purchase, Installation and Commissioning of a minimum of one new building system and the existing building commissioning of a least one existing system.

PROJECT TEAM GUIDE: PARTIAL

Details the implementation of an ID process for a project scope that includes the Purchase, Installation and Commissioning of a minimum of two building systems and one building envelope component.

PROJECT TEAM GUIDE: SUBSTANTIAL

Details the implementation of an ID process for a project scope that includes the Purchase, Installation and Commissioning of most building systems and building envelope components.

PROJECT TEAM GUIDE: COMPREHENSIVE

Details the implementation of an ID process for a project scope that includes the Purchase, Installation and Commissioning of all building systems and building envelope components through the use of customized process protocols and benchmarks.

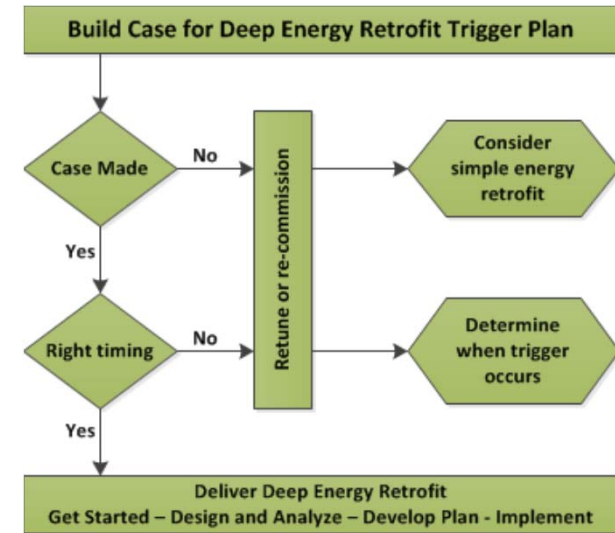
ID AER Roadmap Project Team Guides

Critically important to the implementation of an ID process, the Project Team Guide outlines the activities involved in each scale of retrofit using phased Checklist and Guidelines. The Project Team Guide includes four separate documents developed for use by professionals that make up the team.



Building Energy Retrofits and Asset Management Planning

- Speaks language of commercial real estate
- Leverage end of useful life of major equipment replacements to evaluate related building systems in context of a deep retrofit.
 - Efficiency portion of investment becomes incremental
 - After reducing thermal and electrical loads, the capital cost of replacements may be lower
- Tenant changes: retrofit costs become incremental and can offset other expenses, especially when upgrading a building’s class level.
- Finance building energy upgrades during purchase transaction.
- Delivering low-cost energy asset planning requires:
 - low-cost whole building analytics
 - private/public economics that reduce planning cost/risk



Phase I Retrofit Results

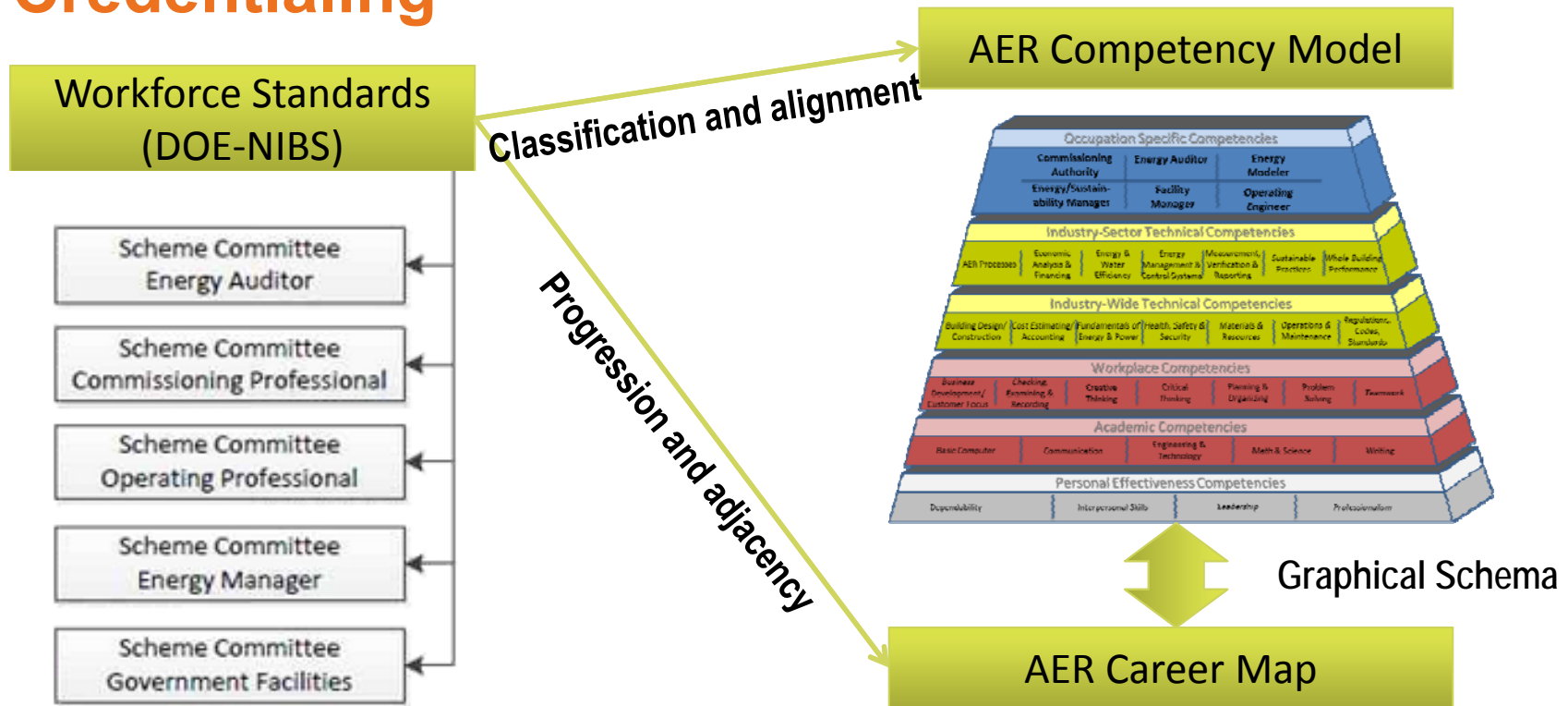
The annual electric savings was found to be \$42,824 and annual gas savings were \$12,559. The simple payback period for this retrofit was 2.7 years.

End Use	Pre-Retrofit Consumption (KWh)	Annual Savings (KWh)	Annual Cost Savings
Exterior Lighting	16,316	3,600	\$529
Interior Lighting	266,603	56,422	\$8,294
Exhaust Fans	13,884	9,880	\$1,452
AHU supply fans	184,697	112,756	\$16,575
Cooling	250,001	108,660	\$15,973
Total	731,501	291,318	\$42,824

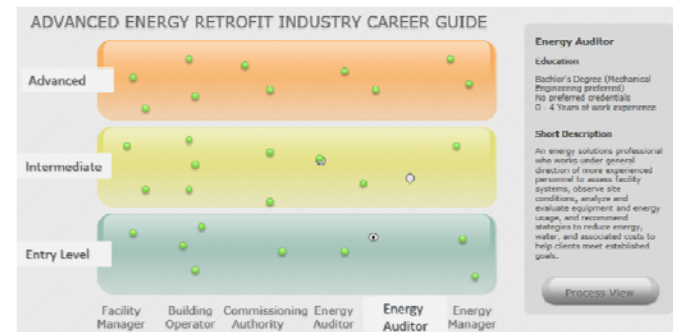
Item	Capital Investment
Exterior Lighting	\$2,700
Interior Lighting	\$17,300
Building Automation System	\$81,300
VFDs	\$17,500
T, RH, CO ₂ sensors	\$9,500
Software Light Switches	\$11,760
TAB	\$16,300
Controls Retrofit	\$146,860



Advanced Critical AER Education, Training and Credentialing



Accomplishments: (1) Provided version 1.0 competency model to NIBS in support of workforce standard development (2) Developed and tested portable and scalable education strategies in key value-added building energy auditing processes (3) Developed draft job descriptions for entry, mid, and advanced positions in key verticals



Thank you

