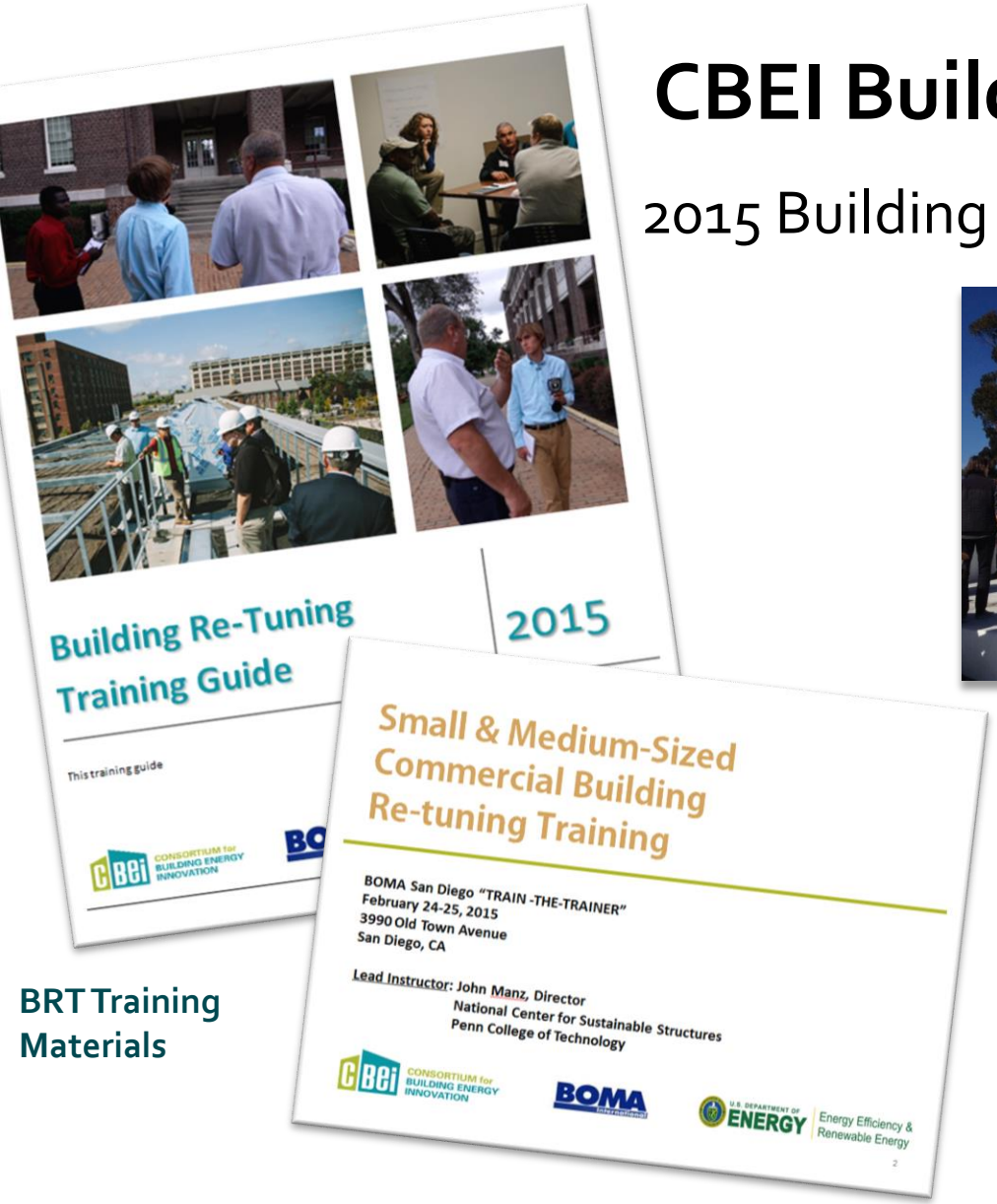
CBEI Building Re-Tuning Training

2015 Building Technologies Office Peer Review



BRT Training Materials

San Diego BRT Training

Milwaukee BRT Training

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

Lisa Shulock, CBEI / The Pennsylvania State University

Project Summary

Timeline:

Start date: 1/1/2014

Planned end date: 4/30/16

Key Milestones

1. Revise & develop curriculum/program for train-the-trainer audience and deliver first pilot Building Re-Tuning Training with BOMA in October 2014
2. Revise and deliver second pilot Building Re-Tuning Train-the-trainer with BOMA in February 2015
3. Establish Learning Management System platform for trainers to deliver BRT

Key Partners:

CBEI/Penn State
BOMA International
CBEI/DVIRC
Pennsylvania College of Technology

Budget:

Total DOE $ to date: $266,000

Total future DOE $: $327,000

Target Market/Audience:

Building owners/managers; the commercial buildings industry education and instruction community; building operators and facility engineers

Project Goal:

Position the Building Re-Tuning Training program originally developed by PNNL to be delivered at scale to in-person audiences and create a sustainable deployment model to support mass market penetration.

CBEI CONSORTIUM for BUILDING ENERGY INNOVATION

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

Bayer MaterialScience

United Technologies Research Center

Economic Development Organizations

DVIRC

PIDC

Driving growth to every corner of Philadelphia

Ben Franklin Technology PArtners

Universities

PENNSTATE 1855

NJIT

Penn University of Pennsylvania

Drexel University

Carnegie Mellon University

VirginiaTech 1872 Invent the Future

PURDUE UNIVERSITY

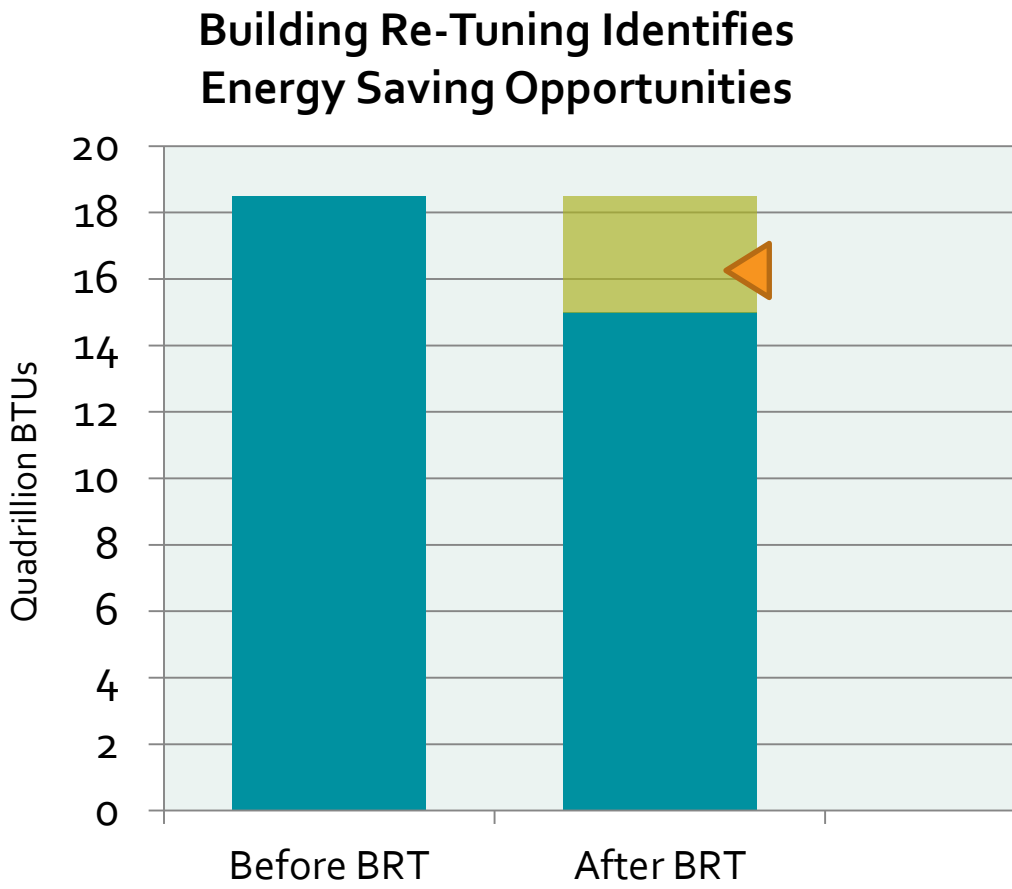
MORGAN STATE UNIVERSITY Gateway to Opportunity Stairway to Excellence

RUTGERS

Purpose and Objectives

Problem Statement: Up to 20% or 3.7 quads of energy consumed in commercial buildings is wasted due to inefficient operations that could be saved with continuous "building re-tuning" performed by the operations staff who are in buildings every day. The building re-tuning training (BRT) program created by PNNL to address this opportunity includes extensive content. The challenge is to revise the re-tuning training program to enable widespread deployment of the training and position the private sector to take over the delivery of training thereby ensuring adoption of re-tuning by building operators/engineers nation-wide.

Up to 20% of energy consumption in commercial buildings is due to inefficient operations



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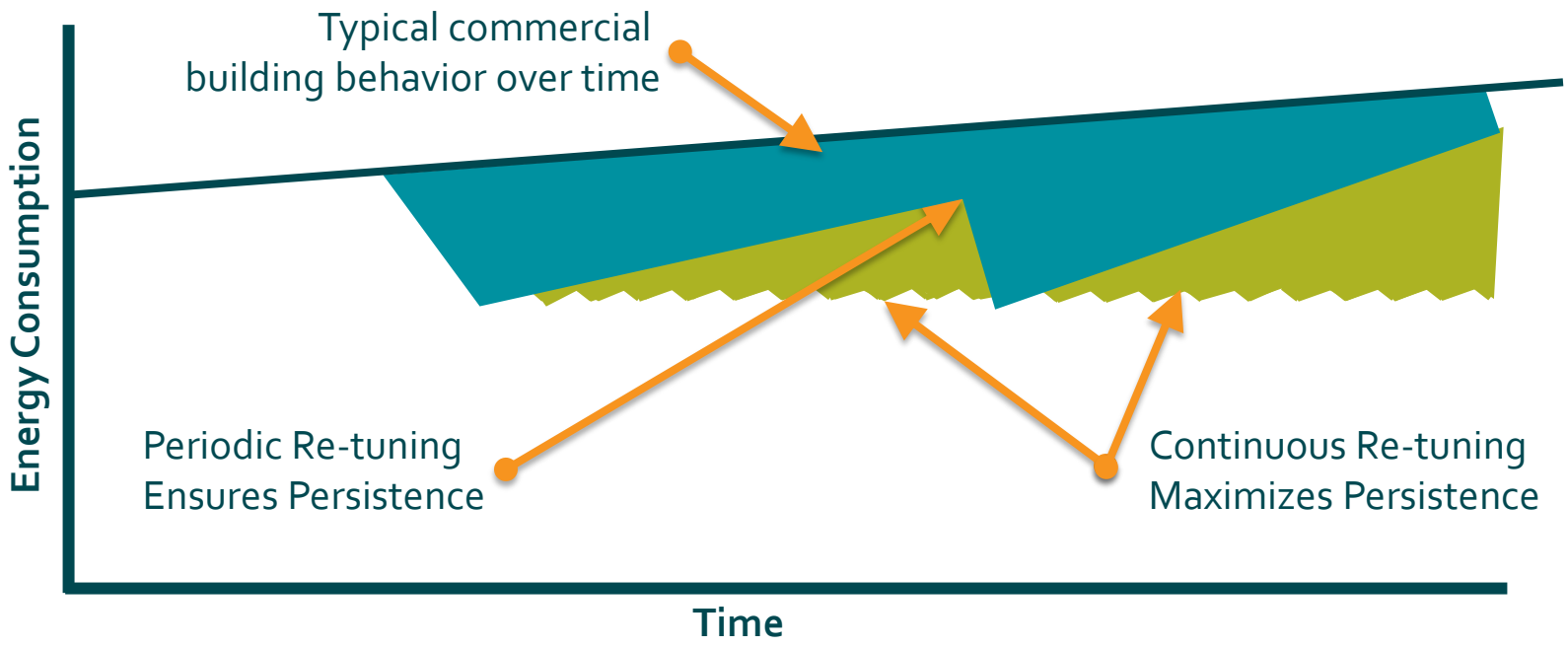
What is BRT? Operational Measures to Save Energy



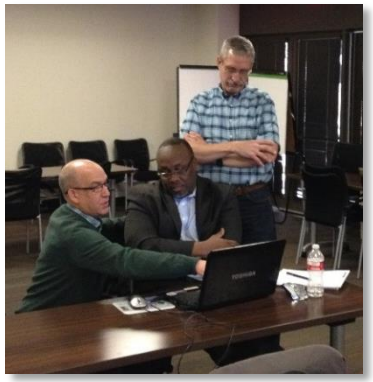
No- and Low-Cost Savings Opportunities Include:

Replacing faulty sensors, adjusting set-points and Building Automation System (BAS) schedules, utilizing variable speed fans and economizers, insulating pipes, adding CO_2 sensors, widening thermostat dead bands, and sealing building envelope leaks

Building re-tuning is a systematic process to identify and correct building operational problems that lead to energy waste.

There are two versions of the training – one for small-medium sized buildings without BAS and one for large buildings with BAS.

How the Building Re-Tuning Training Works



Classroom Training:

- Experts teach the classroom lecture portion, delving into all aspects of the re-tuning process such as efficiency in data collection, optimize AHUs, economizers, zone conditioning, central plants, meter profiles, occupancy schedules, and how to conduct building walk-downs

Building Walk-Down:

- Trainees thoroughly walk down the building including review of envelope, roof, HVAC equipment, plant area, and BAS front end (for large building BRT) to get an in-person understanding of building conditions, design, and operations

Purpose and Objectives (continued)

Target Audience: (1) building owners/managers - need their buy-in to get operators trained; (2) the commercial buildings industry education and instruction community need to understand the benefit of building re-tuning and invest in building re-tuning training; (3) building operators and facility engineers are the audience for building re-tuning training and need to understand benefits of attending training and implementing re-tuning recommendations. This project year the focus is on small-medium buildings without BAS

Best aspect of course was **"getting all the parties involved. And their varied perspectives on different issues."**

Building Engineer, Carleton Management

Impact of Project:

Outputs: modified/enhanced curriculum for end user and train-the-trainer audience; 2 pilot programs for train-the-trainer delivered; training distribution partnership with national organization; sustainable deployment model with national partner

This project will contribute to saving 3.7 quads of energy by expanding the private sector distribution network of Building Re-Tuning Training

Short Term: Identification of national partners willing to invest in delivering pilot train-the-trainer program and follow-through of partner to deliver two pilot Train-the-Trainer sessions

Mid Term: 2 national partners are delivering BRT in multiple regions without federal subsidy

Long Term: At least 4 national organizations are delivering BRT without federal subsidy

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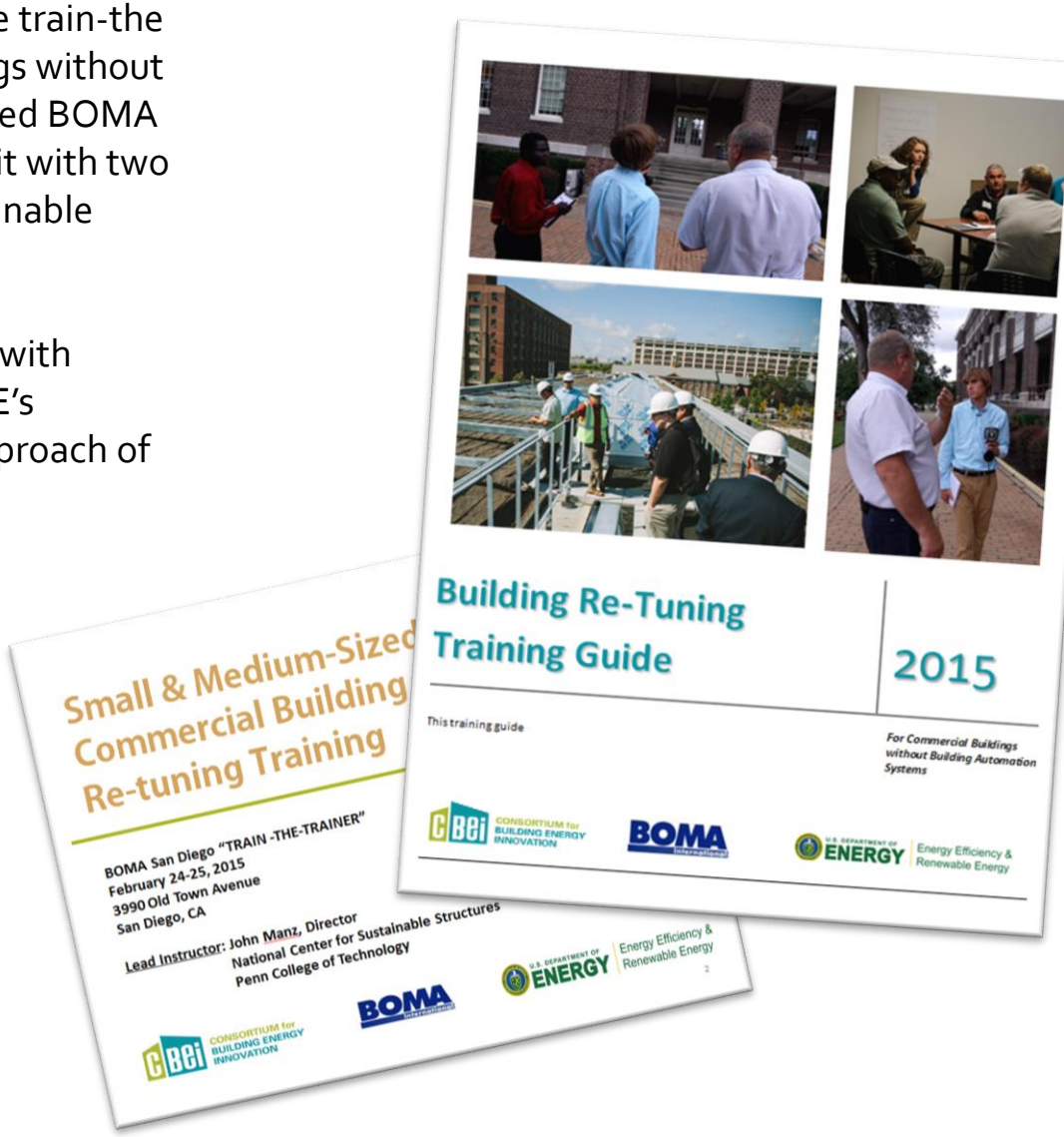
Approach

This year focused on developing and piloting the train-the trainer program for small-medium sized buildings without building automation systems (BAS). We identified BOMA International as our distribution partner, tested it with two BOMA local associations and developed a sustainable deployment model.

Non-BAS version comprises two-day classroom with hands-on building walk-throughs; builds on DOE's investment in BRT to change the culture and approach of building operators through re-tuning training.

Key Issues:

Identifying people willing to commit to delivering BRT training after attending the train-the-trainer requires directed recruitment and screening; first pilot training results indicate few if any attendees intend to be a BRT trainer; second pilot results are more promising in terms of attendees stating they intend to deliver BRT



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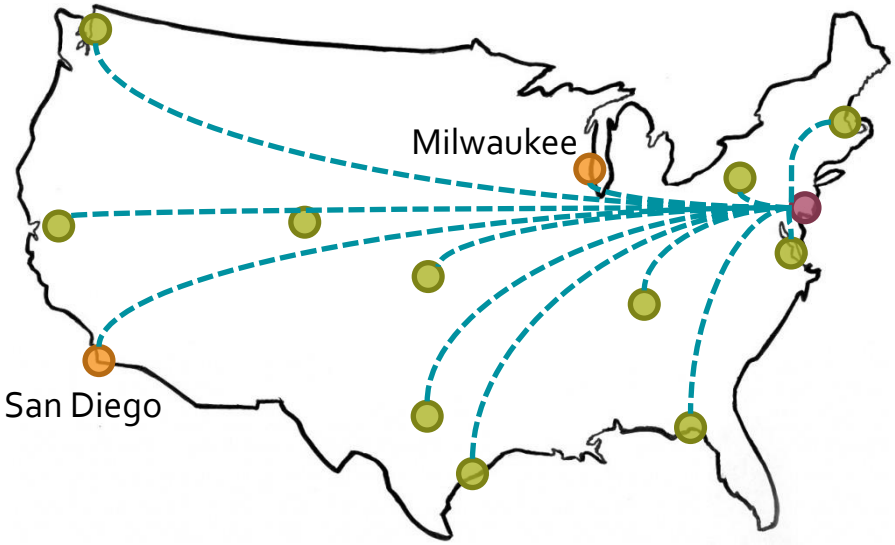
Approach

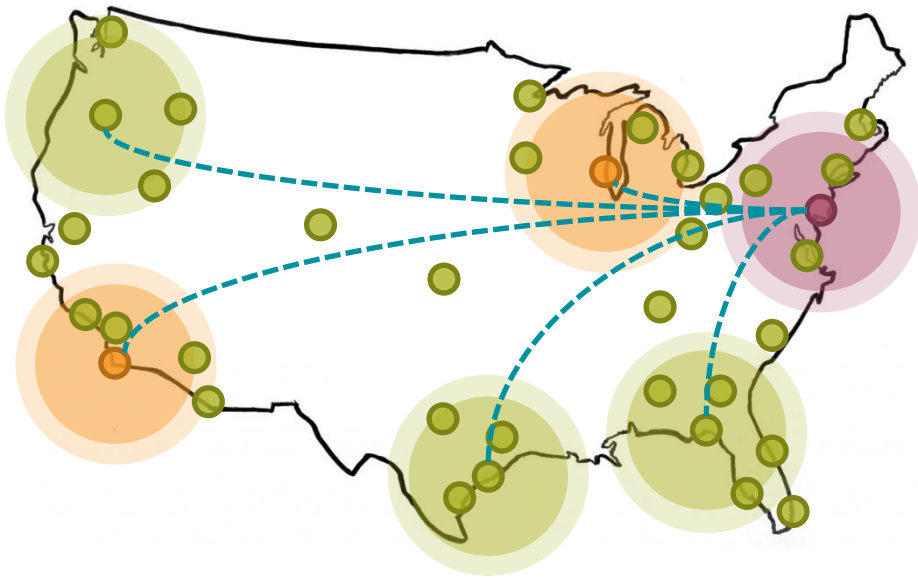
Challenge is wide-scale deployment – transition training from national lab (PNNL) with limited training capacity to private sector and hundreds of trainers

Our Strategy for addressing this challenge was to develop a train-the-trainer program that could be widely disseminated by national deployment partners

Master Training approach:



Regional Train-the-Trainer approach:



- Development Hub / Philadelphia
- Cities/Areas in which train-the-trainer has been delivered
- Emerging cities/areas in which train-the-trainer could be delivered

Approach

Distinctive Characteristics of BRT:

- Focus on low cost/no cost efficiency improvements is important because financing and lengthy approval processes are avoided.
- Energy savings can be immediate (changing set points, modifying occupancy schedules, etc.)
- Training the people who are in the buildings every day to observe energy saving opportunities and act – not reliant on commissioning agents and professional engineers.
- Hands-on, on-site building walkthroughs make this training distinctive and transformative for the building operators who participate. Evaluations consistently rate the walkthrough as most useful component of the training.
- Related project is leveraging BTO's investment in BRT with support from PA's State Energy Program (also DOE funds) to test how engineering students can be trained in building energy operational efficiency and support re-tuning efforts through a 3-credit engineering design course at Penn State to be disseminated to other colleges.

Best aspect of course was **"seeing actual equipment and hearing/seeing 'real life' issues/problems and how they were solved."**

Approach

Distinctive Characteristics of this project:

- Using national distribution partner – BOMA International – to reach target market for training delivery
- Leveraging DOE/PNNL investment in BRT to create rich and highly replicable training experience
- Using Learning Management System to enable easy deployment of classes by hundreds of trainers around the country
- Well-positioned to partner with additional national organizations

Best aspect of course was **"New Awareness, eye opening examples of what to look for during walkdown,"** President, Delta Systems Engineering

Progress and Accomplishments

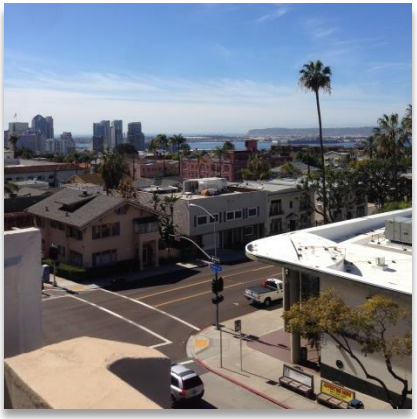
Lessons Learned:

- BRT involves significant culture change and it cannot be addressed without commitment of management and the "push" of established organizations with which building management and operators are affiliated such as BOMA International and APPA (Leadership in Educational Facilities)
- For maximum energy saving results, re-tuning needs to be part of people's job description and included in training rubrics such as GSA is doing with its implementation of the Federal Buildings Personnel Training Act (FBPTA)

Progress and Accomplishments

Accomplishments:

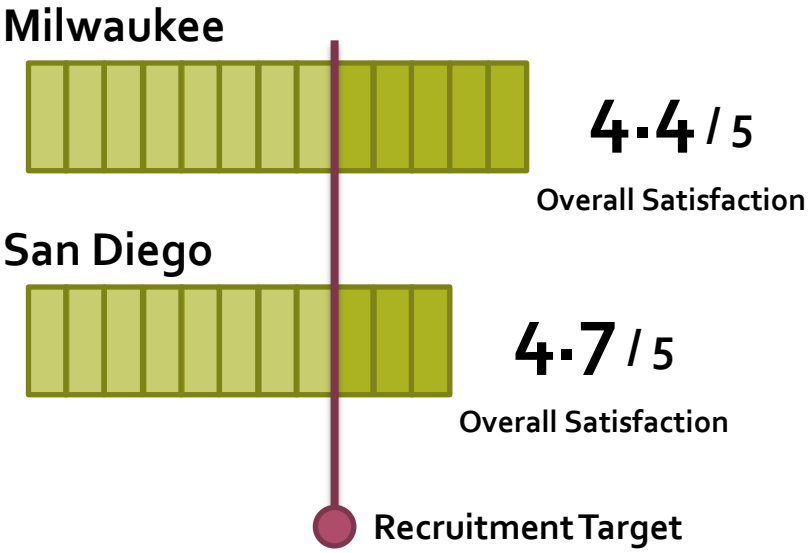
- Developed partnership with BOMA International which independently received funding to pilot BRT train-the-trainer (T-t-T) program in partnership with CBEI
- Selected two BOMA local affiliates (using competitive process) to deliver T-t-T (BOMA Wisconsin and BOMA San Diego)
- Created two new modules for Building Re-Tuning Training and two new modules for the T-t-T audience
- Consolidated and reorganized PNNL training materials
- Created online Learning Management System for course materials and standing-up new iterations of the class
- Identified additional national delivery partner - APPA



Progress and Accomplishments

Market Impact: BOMA Int'l committed to deploying training. Two pilots are informing the deployment model:

- **Milwaukee:** 13 attended (8 was recruitment goal); overall satisfaction with program was 4.4 out of 5
- **San Diego:** 11 attended (8 was recruitment goal); recruitment and screening was improved and more attendees likely to deliver BRT (6 = likely they will conduct Building Re-Tuning training; 5 = maybe); overall satisfaction with program was 4.7 out of 5
- BOMA International planning additional T-t-T for spring and summer
- DOE funding has already leveraged additional funding from PA Dept of Environmental Protection- the students are conducting building re-tunings in municipal buildings and on campus



"Yes, I learned a lot in this course; going to go back and employ this in my buildings."

Chief Building Engineer, CBRE

Project Integration and Collaboration

Project Integration: coordination with industry is through current deployment partner, BOMA International, and future partner, APPA (Leadership in Educational Facilities)

Partners, Subcontractors & Collaborators:

- Consortium for Building Energy Innovation (CBEI)/Penn State University – responsible for overall project mgmt
- Delaware Valley Industrial Reinvestment Center (DVIRC) (Manufacturing Extension Partner) – co-managing project with Penn State researchers
- Pacific Northwest National Laboratories (PNNL) – subject matter experts on BRT provide feedback on new content and training program
- Pennsylvania Department of Environmental Protection – funding related project (BRT in the college classroom)

Communications: International Facilities Management Association (IFMA) Fusion April 2015; BOMA International Every Building Conference and Expo June 2014 and June 2015

CBEI CONSORTIUM for BUILDING ENERGY INNOVATION

DVIRC

BOMA International

Pacific Northwest NATIONAL LABORATORY

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION

APPA

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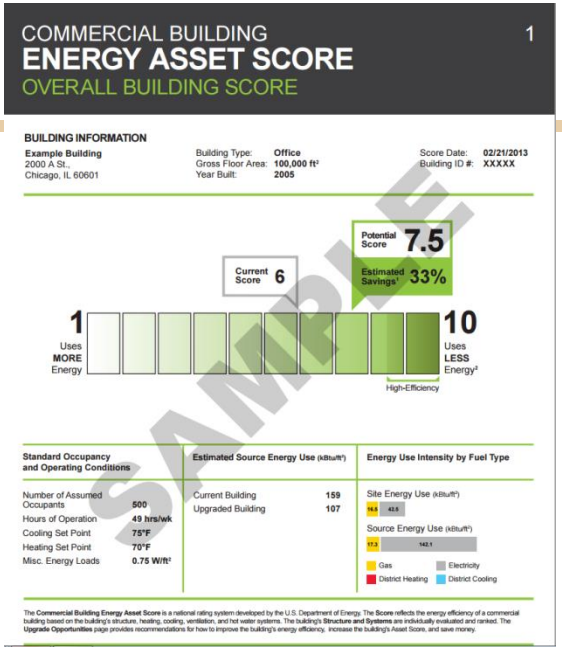
Next Steps and Future Plans

- CBEI to assume responsibility of Building Re-Tuning Training market deployment from DOE
- APPA will be testing slightly different deployment model – they will be convening trainers from each region in the U.S. for the T-t-T and then the trainers will return to their regions and offer BRT
- We will be tracking the outcomes of the different deployment models (BOMA bringing training to local affiliates & APPA bringing master trainers to central location)
- Develop and pilot Building Re-Tuning Training for large buildings with BAS (May 2015-April 2016). Test scalability of training deployment by utilizing blended learning environment with in-person, online asynchronous and remote synchronous training model. Utilize private industry subcontractors to co-develop and co-deliver with expectation they will offer as fee-for-service after April 2016.
- If funding is obtained from PA DEP (through DOE's State Energy Program), continue development of college class and distribute to other institutions to collaborate with university facilities departments to multiply their impact and look at integration of BRT, benchmarking and Asset Score and how they all interact and inform the building operator of energy efficiency opportunities.



REFERENCE SLIDES

Project Budget

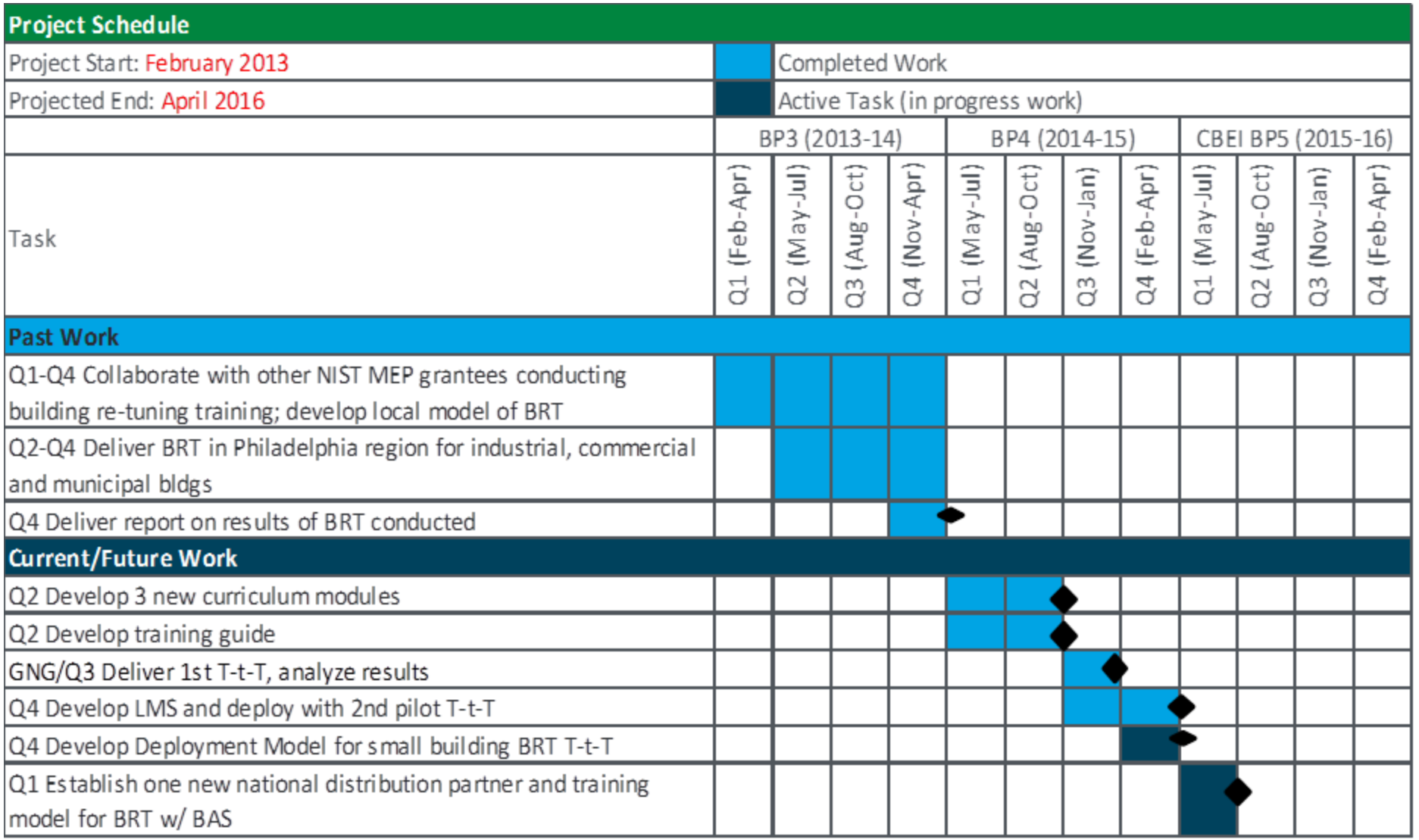
Project Budget:
2013/2014 - $96,000
2014/2015 - $170,000
Variances: none
Cost to Date: $266,000 as of 4.30.15
Additional Funding: Pennsylvania Department of Environmental Protection for related project of integrating BRT into college engineering course ($163,000)

Budget History

CBEI BP3 (past) 2/1/2013 – 4/30/2014		CBEI BP4 (current) 5/1/2014 – 4/30/2015		CBEI BP5 (planned) 5/1/2015 – 4/30/2016	
DOE: $96,000	Cost-share: none	DOE: $170,000	Cost-share: none	DOE: $327,000	Cost-share: $41,000

CBEI – Consortium for Building Energy Innovation (formerly EEB Hub)
BP – Budget Period

Project Plan and Schedule



BP – Budget Period for Consortium for Building Energy Innovation (formerly EEB Hub)