

CBEI - Collaborative Approaches for Integrated Energy Retrofits

2015 Building Technologies Office Peer Review



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

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Project Summary

Timeline:

Start date: February 1, 2013

Planned end date: April 30, 2015

Key Milestones:

1. Three work sessions in collaborative workspace (April 30, 2014)
2. Work with 5 project teams in collaborative workspaces (April 30, 2015)
3. Guide for Interactive Workspace Implementation for Energy Retrofit Projects (April 30, 2015)

Budget:

Total DOE \$ to date: \$ 0.459 M

Total future DOE \$: \$ 0 M

Target Market/Audience:

Project teams with a focus on integrated design solution development to improve building energy performance.

Key Partners:

CBEI – Penn State

Penn State Office of the Physical Plant

Retrofit Project Teams

Project Goal:

To benchmark, evaluate and demonstrate the use of interactive workspaces and information technology infrastructure solutions for efficiently and effectively supporting integrated design teams. The demonstration will leverage interactive workspace components for planning retrofits and will be performed in the Immersive Construction (ICon) Labs.

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

Purpose & Objectives

Problem Statement:

Energy efficient design requires collaboration, and integration of systems, processes and collective team knowledge.

Target Market and Audience:

This project focuses on energy efficient retrofits projects. The primary audience is project team members, and companies, that are focused on delivering energy efficient retrofit projects.

Impact of Project:

Through the development of clear guidelines for creating and implementing interactive workspaces, we aim to improve team integration to better support design decisions that impact overall building energy consumption.

A Core CBEI Focus

Integration of Systems

Integrative Design

INTEGRATION

Integrated Process

Integrated Team

Approach

Approach:

Leverage interactive workspaces to support integrated teamwork to improve design and delivery of energy efficient retrofit projects. We have developed specific workflows to enable the use of interactive workspaces to support the design review process for energy retrofit projects.

Key Issues:

Our target is team integration. A significant challenge within this effort is the shift in approach necessary by project teams (including the owners, architects, engineers, and contractors) to successfully leverage integrated workspaces. We have worked closely with project teams to demonstrate the value that can be obtained with altering common (less collaborative) work practices.

Distinctive Characteristics:

Focus on supporting a project team with a collaborative, interactive work environment that leverages modeling content. Several industry partners have embraced the approach and are either designing their own workspaces, or implementing the ICon Lab facilities for their projects.

Interactive Workspaces

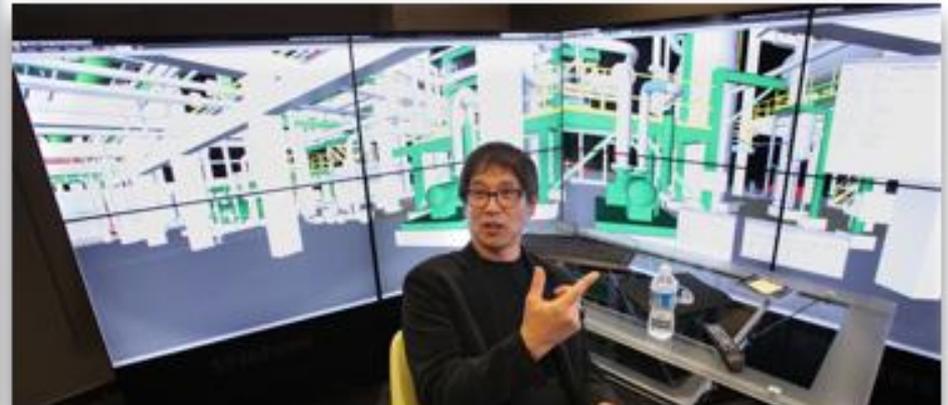
A physically located technology and media enabled project space **facilitating human centered interaction and meaningful collaboration** of project team members utilizing heterogeneous devices and software featuring large format displays, for content sharing and media viewing, and multi-modal interaction systems.



ICon Lab - University Park



VOCC Lab, Oak Ridge



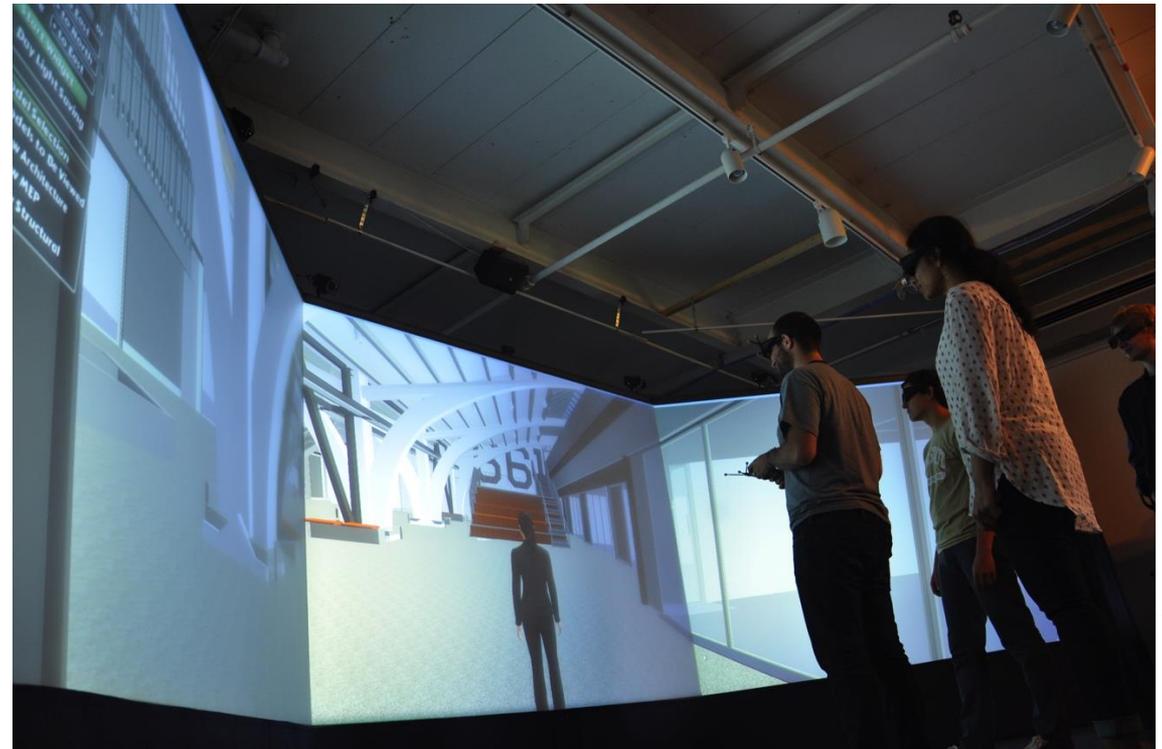
BIM CAVE, Texas A&M

The Immersive Construction (ICon) Labs

The ICon Lab contains an affordable immersive projection display which allows 3D and 4D models to be displayed in stereo at full scale.

Features:

- 3 screen active stereo projection
- User-tracking system
- Video-conferencing
- Interactive whiteboards
- Seats 30 people



Case Study Projects Begin Deployment at National Scale

Michael Baker Building



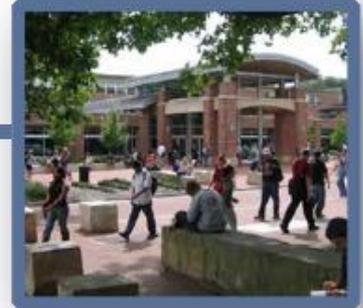
Steidle Building



Brandywine Residence Hall



Brandywine Student Center



May

BP4

May

BP5

2014

2015

Dec



Whitmore Building



Adler Student Center



Abington Residence Hall

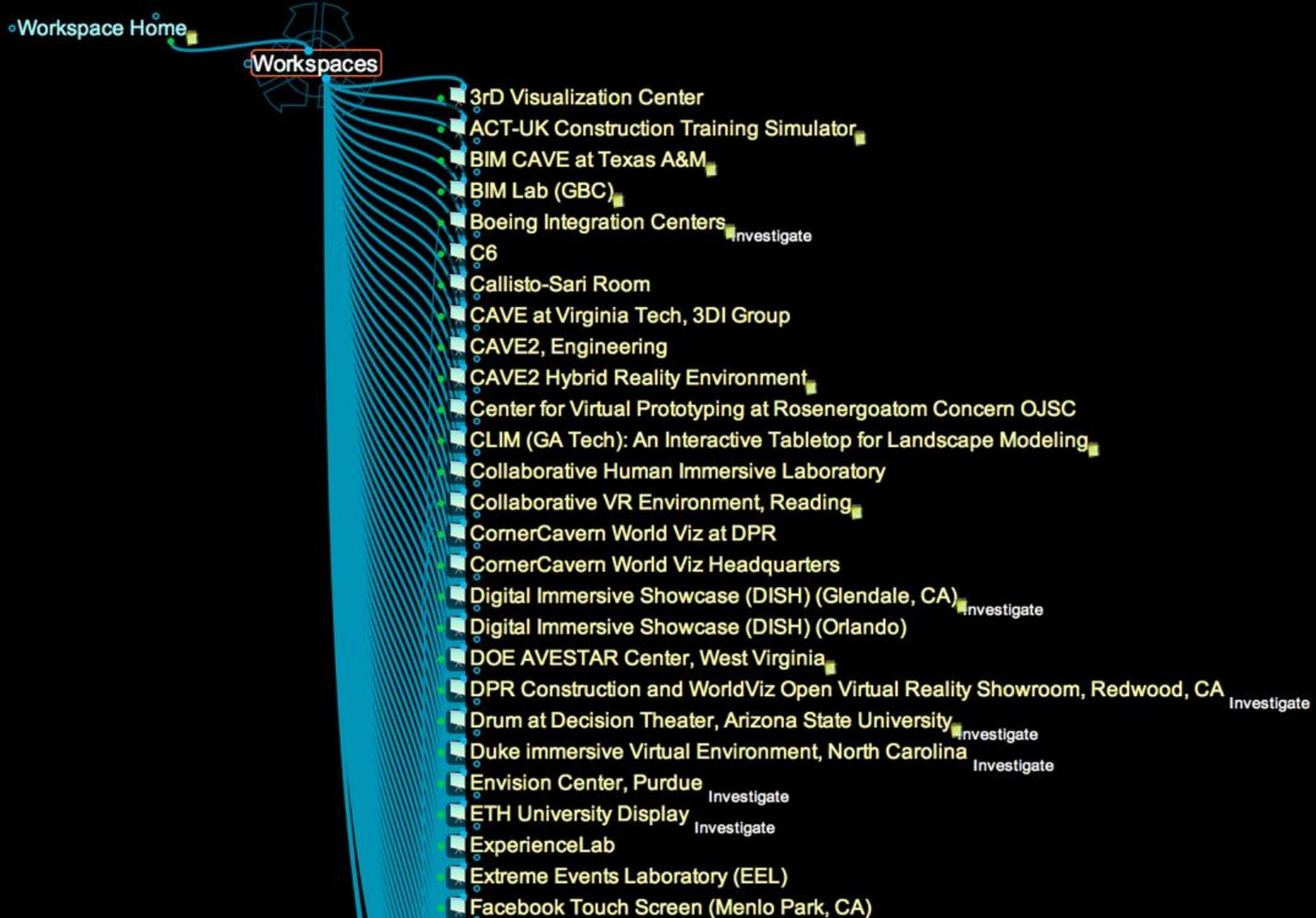


State College High School



Ag Engineering

Database of Interactive Workspaces



Interactive Workspace Use Cases

Design Verification

**End User Design
Reviews**

**Construction
Coordination**

**High Performance /
Building Infrastructure**

PRIMARY USE CASES

SECONDARY USE CASES

Engineering Visualization

CFD Visualization

Big Data

Energy Visualization

Progress and Accomplishments

Lessons Learned:

- Project teams can benefit from leveraging interactive workspaces by gaining knowledge from a diverse group of participants
- We are not changing the analyses, but instead, changing the communication of the results to improve decision making
- Implementation requires a champion

Accomplishments:

- Interactive Workspace Guide will be release at the end of April 2015
- 2 Building Energy Informatics Summits hosted at CBEI Headquarters
- Database of Interactive Workspaces

Market Impact:

- To date, nine projects leveraged the ICon Labs in the design process, and more are following
- Four organizations designing collaborative spaces within their offices based upon project results
- Significant owner (Penn State) is implementing reviews in ICon Lab on all new major projects.

Project Integration and Collaboration

Project Integration:

Project team meetings and visits are frequently scheduled within the ICon Labs. These meetings directly demonstrate the approach to using interactive workspaces to improve integrative design.

Partners, Subcontractors, and Collaborators:

This project is focused on improving the integrative design strategy for retrofitting SMSCB within CBEI. We work closely with project teams performing retrofit projects. One partner is the Penn State Office of Physical plant, who through the demonstration of the value of design reviews, has made it standard practice to implement reviews within interactive workspaces such as the ICon Lab.

Communications:

We have hosted many visitors in the Immersive Construction Labs at the Navy Yard and University Park. Results from this project have been presented at two ASCE Computing conferences and a Construction Virtual Reality conference. Project teams that have worked in the space are our best deployment mechanism with most of our current case studies including at least one repeat team member.

Industry Participants in Case Study Projects



7

Building Energy Informatics Summit



Energy Efficient Buildings Hub

Building Energy Informatics Summit

! ! ! !

May!14! 15, 2013!

Building!101, The!Navy!Yard, Philadelphia!

Goals:

- Share Experiences
- Identify Future Directions
- Connect/Network



2014

2nd ANNUAL
Building Energy Informatics Summit
Hosted by The Consortium for Building Energy Innovation

CBEI Headquarters
The Philadelphia Navy Yard
4960 S. 12th Street
Philadelphia, PA 19112

December 8-9, 2014

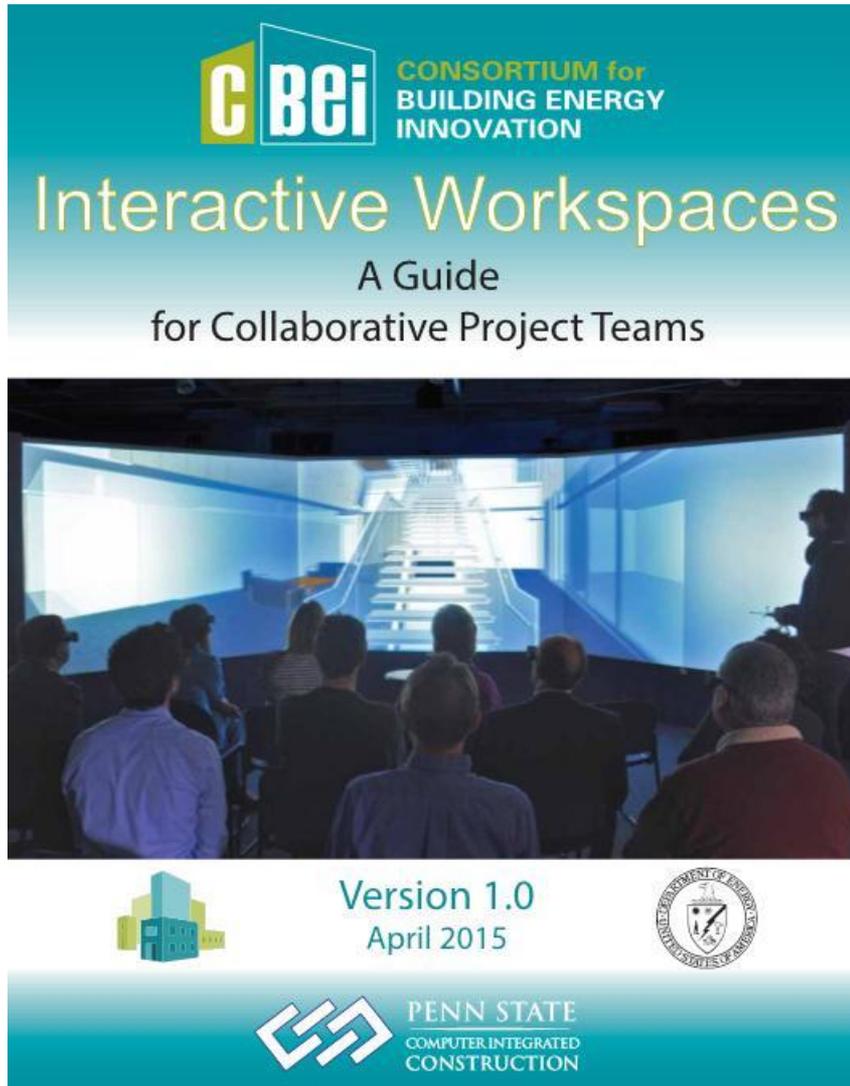
 CONSORTIUM for BUILDING ENERGY INNOVATION

research.cbei.psu.edu

Results:

- Large Congregation of Attendance
- Multiple Sessions & Facility Tours
- Networking Opportunities
- Summary of Future Directions

Next Steps & Future Plans



Interactive Workspaces Guide to be release in April 2015.

DOE support for this project will end in April 2015.

Our team will continue our work with collaborative workspace project case studies via future sponsors of projects.

Will be disseminated on the CBEI website as well as the bim.psu.edu website which has yielded over 20,000 downloads of BIM planning guides.

Acknowledgements

- Industry Participants
- CBEI Team Members
- DOE Collaborators



“Tomorrow’s innovators will invest more in playing with prototypes, modeling marketplaces, and simulating scenarios because that will become the best way to create new value and profitably deliver it to customers. Innovative models inspire innovative behavior.

... the value of prototyping arises from how people behave around prototypes.”

- Michael Schrage from Serious Play (2001)

REFERENCE SLIDES

Project Budget

Project Budget: The project is funded through The Penn State Consortium for Building Energy Innovation. CBEI is a 5 year initiative. The current budget period is Budget Period 4 (BP4) which is from May 1, 2014 to April 30, 2015. BP5 is scheduled to start on May 1, 2015. There is no budgeted work in BP5 related to this project.

Variances: None

Cost to Date: Approximately 90% of the current BP4 funds have been spent to date.

Additional Funding: Matching funds from the Consortium for Building Energy Innovation (CBEI).

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	Cost-share	DOE	Cost-share	DOE	Cost-share
\$180,726	\$60,951	\$278,459	\$48,831	\$0	\$0

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

BP – Budget Period

Project Plan and Schedule

Project Schedule												
Project Start: February 1, 2013	Completed Work											
Projected End: April 30, 2015	Active Task (in progress work)											
	◆ Milestone/Deliverable (Originally Planned)											
	◆ Milestone/Deliverable (Actual)											
	BP3 (2013-14)				BP4 (2014-15)				CBEI BP5 (2015-16)			
Task	Q1 (Feb-Apr)	Q2 (May-Jul)	Q3 (Aug-Oct)	Q4 (Nov-Apr)	Q1 (May-Jul)	Q2 (Aug-Oct)	Q3 (Nov-Jan)	Q4 (Feb-Apr)	Q1 (May-Jul)	Q2 (Aug-Oct)	Q3 (Nov-Jan)	Q4 (Feb-Apr)
Past Work												
1st Building Energy Informatics Summit	■	■										
3 Demonstration Projects in Year 3	■	■	■	◆								
Form Industry Advisory Board					■							
Benchmark Interactive Workspace Facilities and Use Cases					■	◆						
2nd Building Energy Informatics Summit					■	■	◆					
5 Additional Demonstration Projects in Year 4					■	■	■	◆				
Develop Interactive Workspace Guide						■	■	◆				

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