

Window Daylighting Demo: Accelerated Deployment of Daylighting and Shading Systems

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April 4, 2013

Problem Statement:

- Façade has large energy impacts. Cooling and lighting average ~ 40% of energy use in commercial buildings and often >50% in peak electric demand.
- Many glazing/shading/daylighting options exist, but selecting the “best” solution is challenging since it changes with orientation and climate, and impacts visual comfort and view.
- Facilitate handoff from DOE Emerging Technology → Commercial Integration

Impact of Project:

- 10-50% lower EUI in commercial buildings; downsize chillers, better comfort
- Potential sector savings range from 1.2 - 2.2Q energy if optimized shading/daylighting systems are widely adopted in entire commercial building sector.

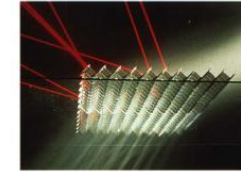
Project Focus:

Accelerate adoption and widespread deployment of improved shading and daylighting systems in new and retrofit commercial buildings:

- 1) Scoping Study: Survey and evaluate candidate shading and daylighting systems that are applicable to windows and curtain walls
Simple low cost retrofits ←-> Operable, automated “smart” systems
- 2) “Reality-based” Performance Data: Field Demonstration and Testbed projects;
- 3) “Toolkit” for Outreach, Replication, and Deployment

Approach

- 1) Assess current state of the art in technology, performance Shading/Daylighting Systems; New and Retrofit;
- 2) Dual market path- “low end” and “high end” products
- 3) “Toolkit” for Designers and Specifiers
- 4) Promote adoption of existing and emerging solutions
- 5) Feedback for New Technology R&D → BTO/Emerging Tech



Key Issues

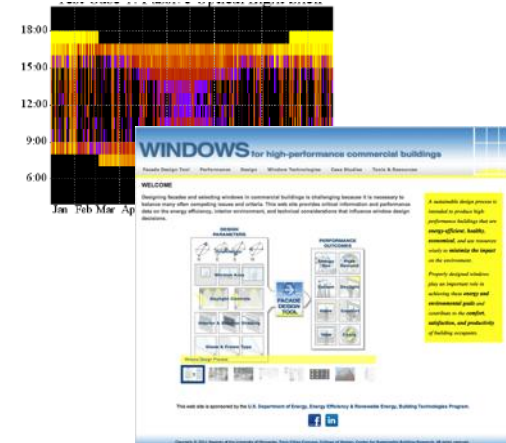
Address Design, Technology, Cost and Operations

- Objective, accurate underlying data

Two Pathways to Accommodate Building Type/Owner

- Low cost, fixed simplified solutions
- Automated, high tech, smart solutions

“Useful”, “Usable” Toolkit to Specify



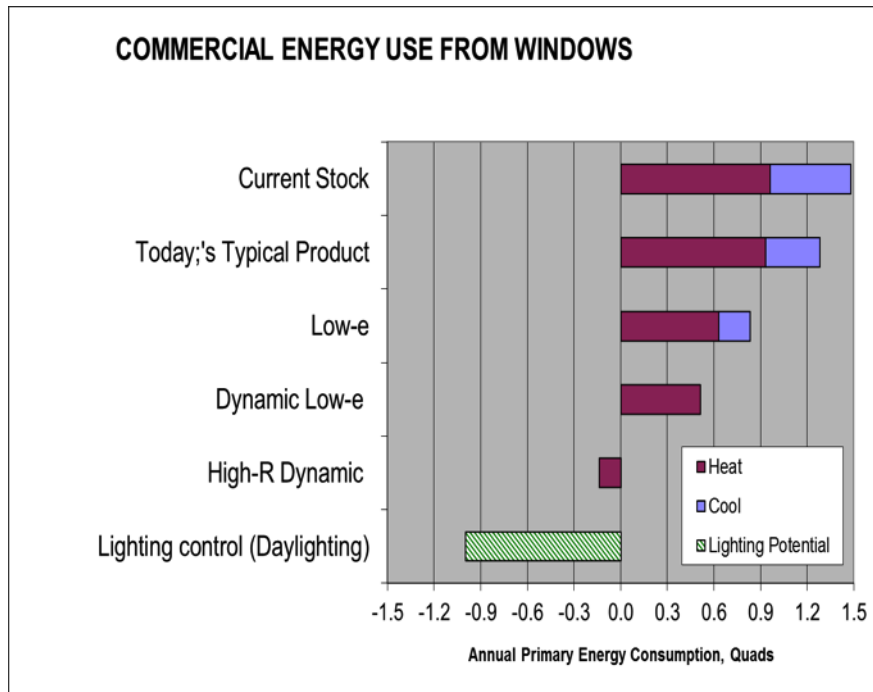
Distinctive Characteristics (unique aspects of approach)

- Sound performance data and “accurate” validated tools
- Address Energy, Cost and Market issues- e.g. comfort
- Tools and Data for Scaled Deployment
- Reality-based: based on what works in the field



- Overall commercial market opportunity:
 - 1.5 quads (2.5 quads with lighting savings from daylighting controls)
- Short term goals:
 - Optimize energy use by optimal selection from existing market solutions
 - Increase savings with better use of existing product lines or tweaks to existing products
- Longer term goals: Create Market Pull for New cost effective, enhanced product options

Challenge: Savings Potentials vs Reality(?)



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Automatic Shades Inspire Office Frustration

Smart blinds cut power use, but workers find them maddening

By Karen Weisa

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RELATED ITEMS

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THIS WEEK

February 27, 2012
Scored in the USA

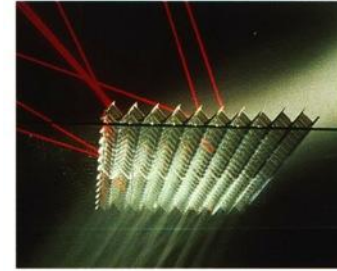
The Seattle building Brent Rogers designed for his architecture firm, NBBJ, has won awards for its natural light, flexible workspace, and sustainability. Yet when Rogers moved in, he soon grew frustrated by a key element of the green design: the automated window blinds, which went up and down with little apparent reason. "At times it seemed random," recalls Rogers. "And at times it was random."

Maximizing daylight can cut a building's lighting bill by as

What is Available? Does it Perform?

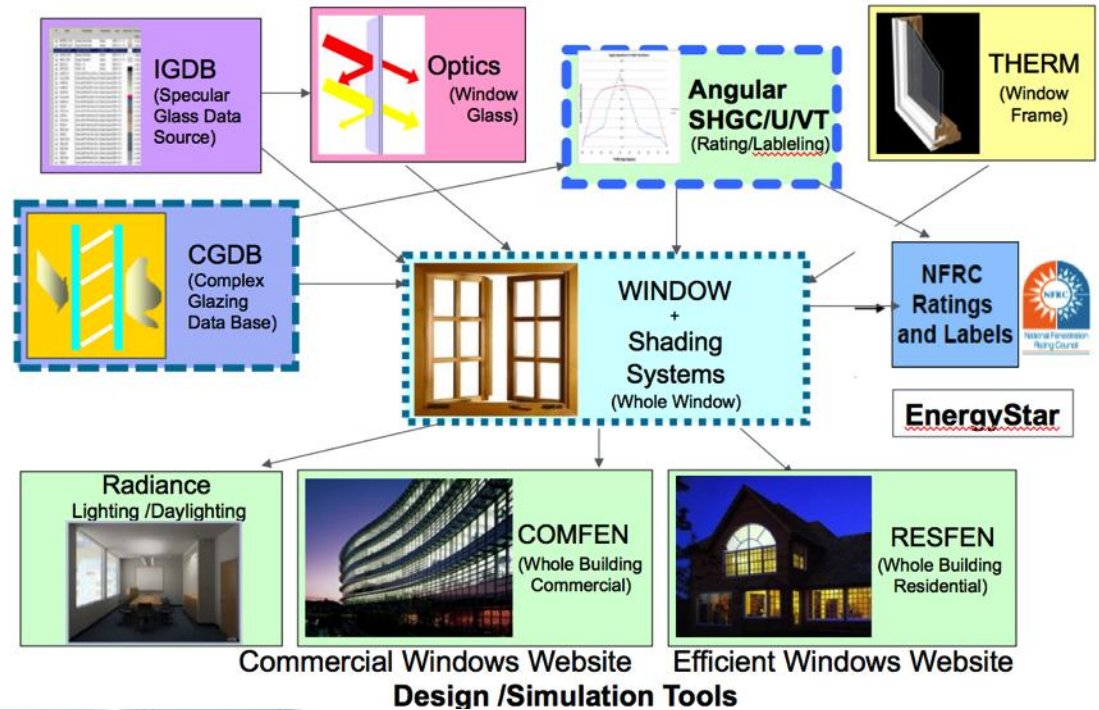
Options for Sun Control, Light Control

- **Insulating Glazing Units**
 - Spectrally selective glazings
 - Light redirecting glazings
 - Electrochromic/Thermochromic
- **Interior Devices**
 - Fixed, Manual, Automated
- **Exterior Devices**
 - Fixed, Manual, Automated



Approach: Decision Support Tools

A suite of integrated tools and data bases for predicting 1) “Properties” of window and shading systems and 2) Energy Performance



A fleet of integrated indoor and outdoor lab facilities and testbeds for measuring “properties” of window, shading systems, and validating software tools

Approach: Tools (2)

- Guides and Books
- Websites : www.commercialwindows.org
- Interactive Tools - COMFEN

Handbook for Architects and Engineers:
Window Systems for High Performance Buildings

WINDOWS for high-performance commercial buildings

Design Guidance for Offices in Washington, DC

Introduction
The energy use of a perimeter zone in an office building depends on several design decisions—window operation, window area, shading conditions, glazing type, and window lighting controls are used in the design. Designers need to know the answers to the following questions: What is the best orientation, window area, and glazing to reduce energy use in a particular location? Are shading devices and lighting controls effective in saving energy? Unfortunately, the answers to these questions are not quite as simple as they seem. For example, there is a general perception that spaces with larger window areas use more energy than spaces with smaller window areas. This may be true for conventional clear glazing, however, with high performance glazing, a space with a large window area can use the same amount of energy or even less energy than a space with a small window area. The best option is not always the design to be aware of these advanced calculation tools to optimize design decisions.

To provide guidance to designers, the U.S. Department of Energy has been called upon to conduct research on the energy use impacts for perimeter zones, DC. The energy use has been called design variables including four variables: window glazing type, window shading control system. The assumptions are: All simulations were performed using a 100% clear glazing, however, with high performance glazing, a space with a large window area can use the same amount of energy or even less energy than a space with a small window area.

A sustainable design process is intended to produce high-performance buildings that are energy-efficient, healthy, economical, and use resources wisely to minimize the impact on the environment. Properly designed windows play an important role in achieving these energy and environmental goals and contribute to the comfort, satisfaction, and productivity of building occupants.



TIPS FOR DAYLIGHTING



Daylight in Buildings

A SOURCE BOOK ON DAYLIGHTING SYSTEMS AND COMPONENTS



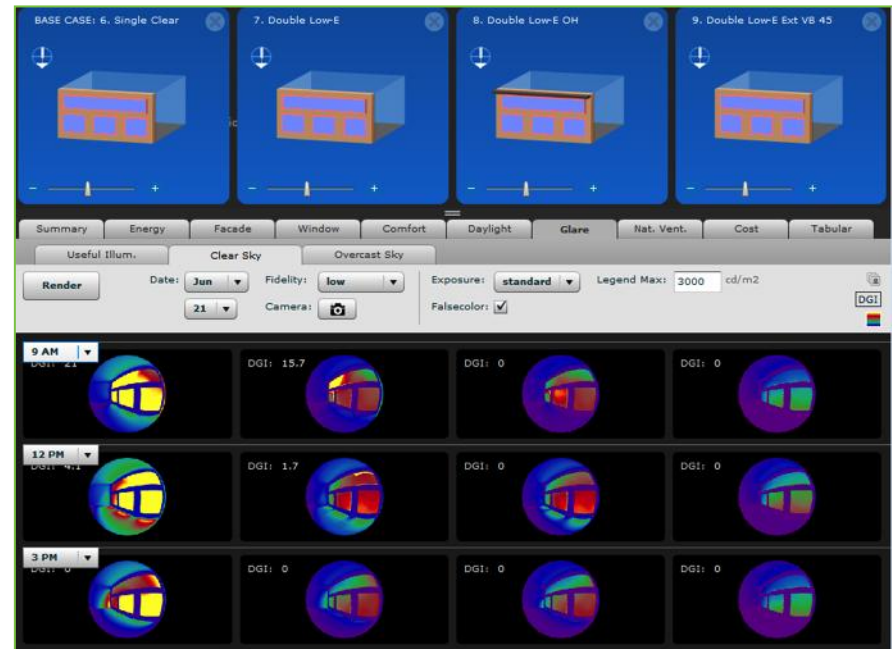
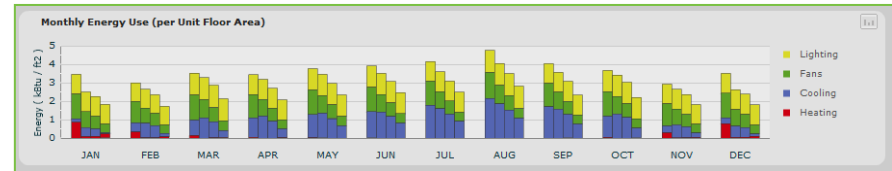
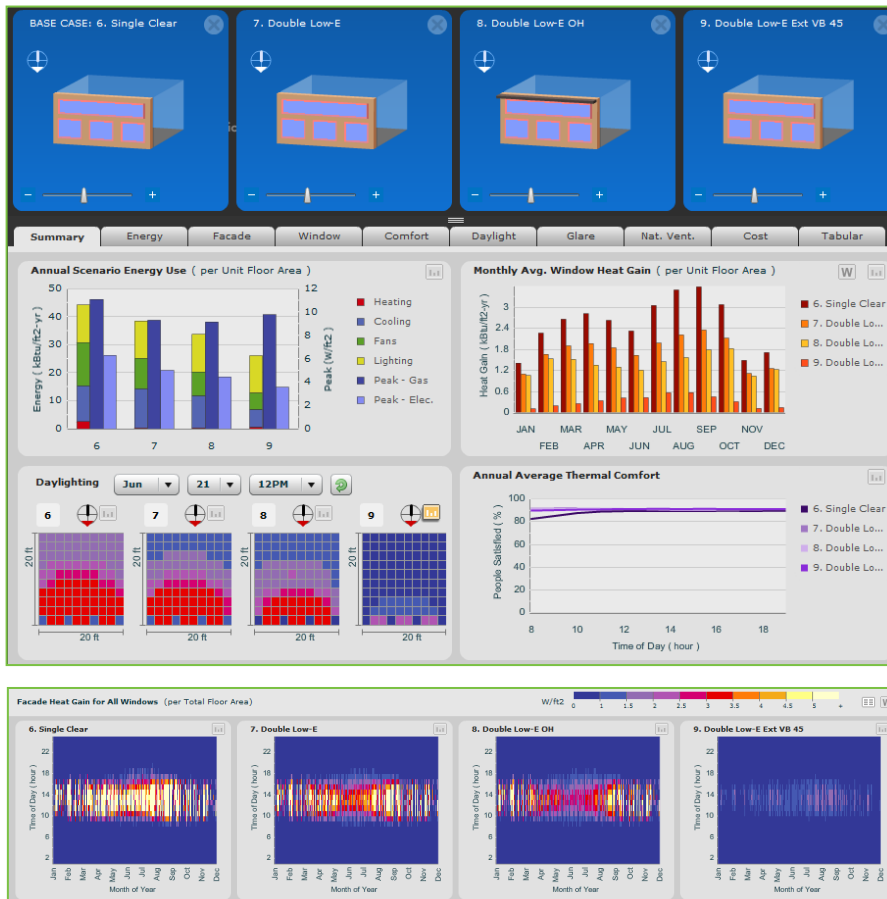
Approach: Tools (3)

COMFEN: Impact of Window Selection

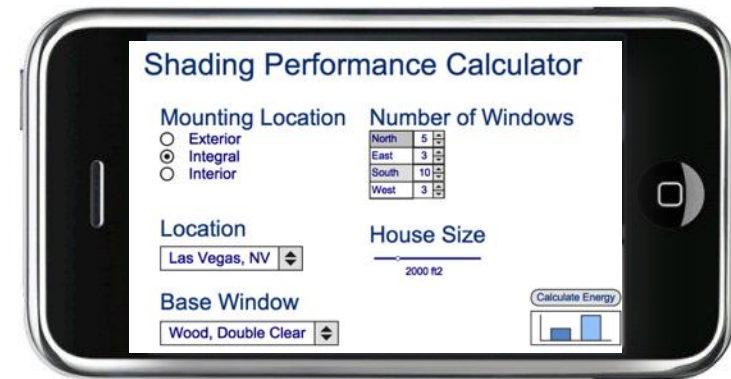
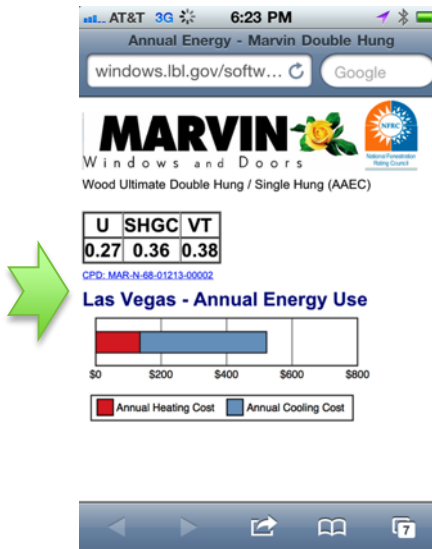
Early Design Scenario comparisons

- Rapid analysis of façade options in early design development
- Easy to learn, easy to use
- Powerful tools under the hood (E+, Radiance, WINDOW 6)

Strong positive response from early adopters (architects / engineers)



- Enhanced COMFEN Tool with:
 - - Integrated Educational Website
 - - Integrated Case Studies
 - - Expanded Cost Data Base
- Explore Crowd Source Data Models
- Explore Role of Smart Phone Based Tools for On Site Retrofit



Approach: Testbeds <-> Buildings

What is the realistic, in-situ “performance” of window, shading and daylighting systems?

Metrics: Energy, Demand, Comfort, Appearance, Cost



VB-E1n (exterior) VB-E1n (interior) VB-E3opt (exterior) VB-E3opt (interior)



VB-E2n (exterior) VB-E2n (interior) RS-E-autoll (exterior) RS-E-autoll (interior)



Completed Scoping Study

- Identified a wide range of shading and daylighting products and systems
 - 1) small to moderate window size; fixed shading solutions
 - 2) moderate to large size: automated interior/exterior shading w/ daylighting
- Undertook systematic study to select “most promising” for potential field measured Case Studies
- Engaged with Manufacturers to develop potential collaborative efforts
- Identified Case Study Buildings for Potential Field Studies
 - Assessed viability of each site against key project criteria
- **Developing Simplified, Short Time Period Assessment Methods**
 - Rather than longer term, more costly assessment methods
 - Shift in project focus from small number of longer term projects to larger number of shorter term monitoring
- **Developing New COMFEN Tool Concept with Integrated Case Studies**
 - Built in links to Website educational materials
 - Built in links to Case Study Data Base

Project Plan & Schedule

Initiated/ planned completion date: 2013 to 2015

Go/no-go decision points:

Stage Gate after Scoping Study: 2/2013 – Approval to proceed (slipped 1 month)

Key milestones for FY13 and FY14 Shown Below

Detailed FY15 Plans, Milestones to be developed in FY14

Summary					Legend											
WBS Number or Agreement Number					Work completed											
Project Number					Active Task											
Agreement Number					Milestones & Deliverables (Original Plan)											
					Milestones & Deliverables (Actual)											
					FY2013				FY2014				FY2015			
					Q1 (Octt-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Octt-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Octt-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
Task / Event																
Project Name: Accelerating Deployment of Shading/Daylighting																
Q1 Milestone: Scoping Study																
Q3 Milestone: Case Study Building Plan																
Q3 Milestone: Web site plan, toolkit plans																
Q4,2 Milestone: Complete Short Term Field Studies, Buildings and Testbeds																
Q4 Milestone: Longer term field studies (TBD)																
Q4 Milestone: Updated Toolkit																
Q2 Milestone:Detailed FY15 Plans																
Future Activities FY15																
Toolkit Updates																
Field Test Updates																
Technology Updates																
Training and Education Programs																

Project Budget (FY13 \$450K) New Start in FY13

Task 1. Scoping Study (\$50K)

Task 2. Shading/Daylighting Technology Survey (\$50K)

Task 3. Field/Testbed Case Studies (\$150K)

Task 4. COMFEN/website façade design tool/resource (\$150K)

Task 5. Outreach Program (\$50K)

Variations: Revised workplan accepted Feb 2013

Cost to Date: \$122K FY13 spent to date

Additional Funding: ~\$100K, in-kind from Manufacturers; Calif Energy Comm. Support for COMFEN

Budget History

FY2010		FY2011		FY2012	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
0		0		0	

Project Integration, Collaboration & Market Impact

Partners, Subcontractors, and Collaborators

Website team: Univ of Minnesota

Building Owners: public, private, industry associations- supply sites

Technology Suppliers: Shading Systems, Daylighting systems- data

Architect/Engineer/Contractor: early adopters

“Agency Partners”: DOD, GSA, Utilities,..

Technology Transfer, Deployment, Market Impact

COMFEN Tool: <http://windows.lbl.gov/software>; **Website:**

<http://www.commercialwindows.org>

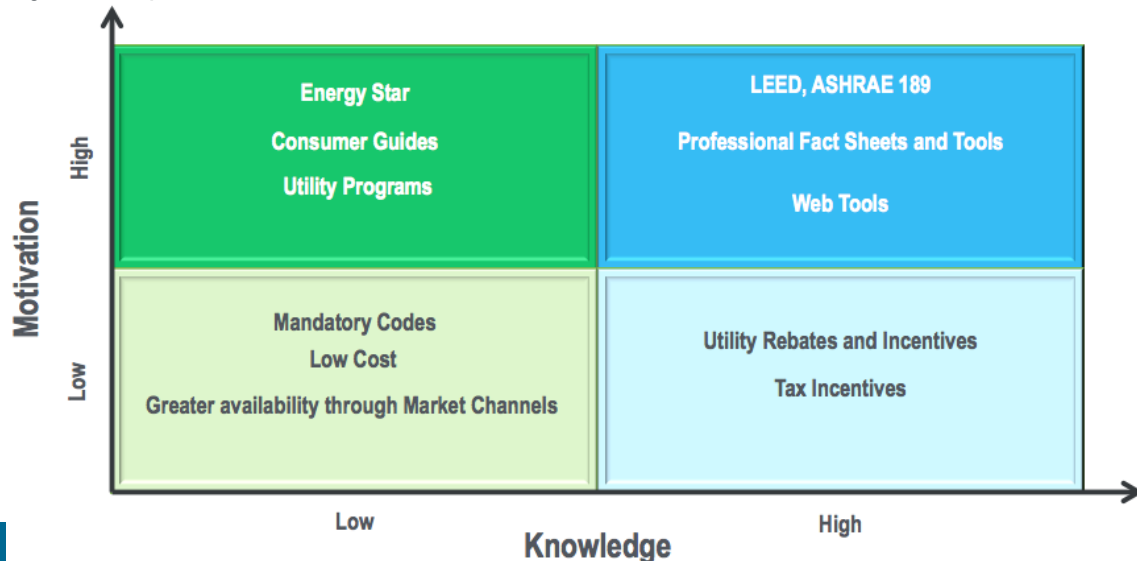
“Train the Trainers”: ex: Architectural firms

1. Intro and Level 1 Webinars
2. “Lead trainer” or contact in each firm

Track Downloads and Tool Use (anonymous); Track Trends in Market Sales

Communications: workshops, webinars, conferences,.....

- 7 Conferences including: Glassbuild/GANA; AAMA; WDMA; NFRC; Building Enclosure Council (BEC)
- Professional Societies/CEUs: AIA, CSI, ASHRAE; IES, LightFair
- Greenbuild, Green Light NY, Utility Workshops



FY14-15: On an ongoing basis:

1. Update Technology Surveys

- New data on existing products/systems
- New products/systems

2. Update Demonstration site data

- More data from existing sites
- Add new sites
- Explore “crowd source” model for new sites/data

3. Update Tools and Websites and “Outreach”

- Technical updates from BTO/ET R&D programs
- Interface and usability updates in response to user needs
- Conferences, workshops, CEU, Webinars, Publications.....

4. Deployment planning: Coordinate with all BTO/CBI programs and with other public and private demonstration program: e.g.:

- GSA Green Proving Ground program
- DOD ESTCP Demonstration program
- Green Light NY; Utility programs; Architecture 2030;.....

FY16 → “2030”

Develop sustainable business model to provide required data, services