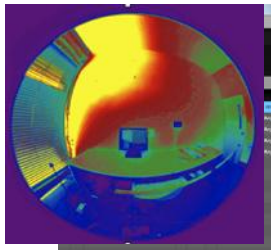


Window Daylighting Demo:
Accelerated Deployment of Daylighting and Shading Systems

Stephen Selkowitz

Lawrence Berkeley National Laboratory

seselkowitz@lbl.gov 510-486-5064

April 4, 2013

Purpose & Objectives

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

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

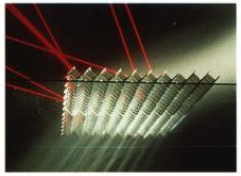
Address Design, Technology, Cost and Operations
- Objective, accurate underlying data

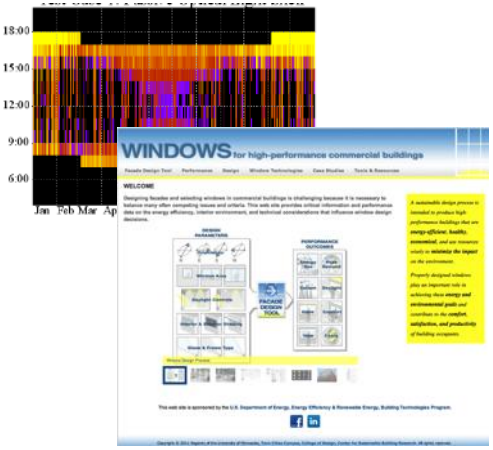
Two Pathways to Accommodate Building Type/Owner
- Low cost, fixed simplified solutions
- Automated, high tech, smart solutions

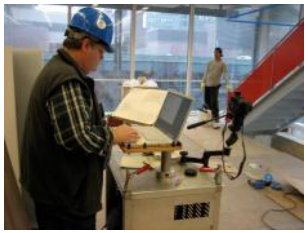
“Useful”, “Usable” Toolkit to Specify

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



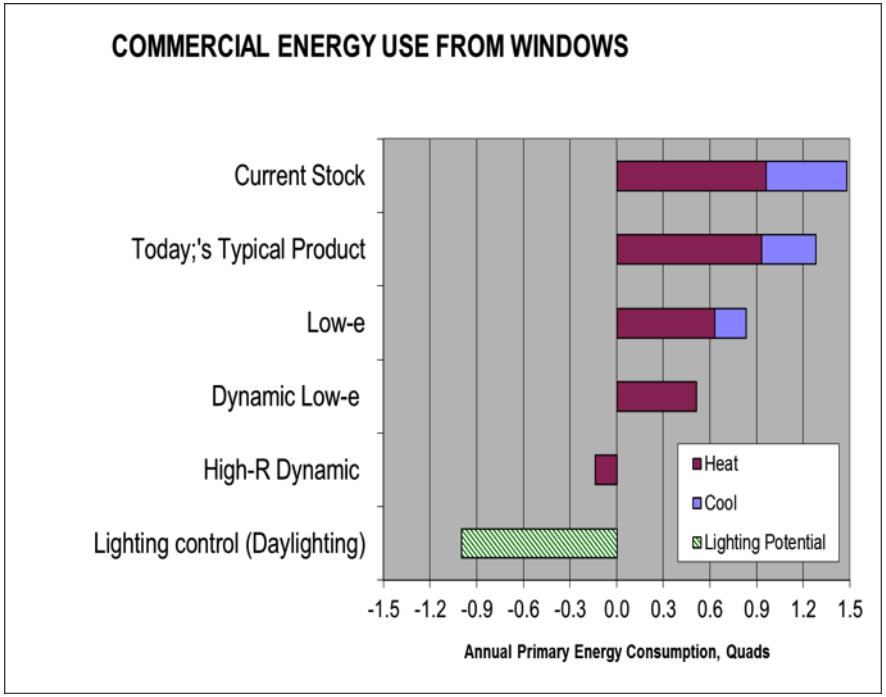


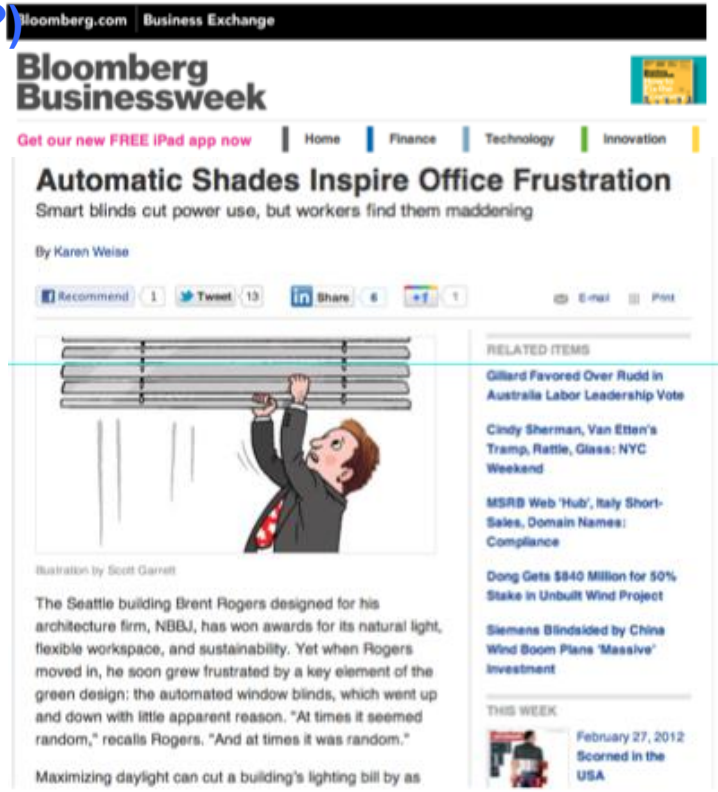


Approach/Background 1

- 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(?)



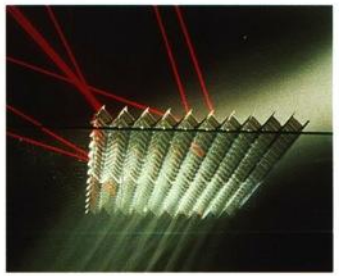


Approach: Technology Assessment

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



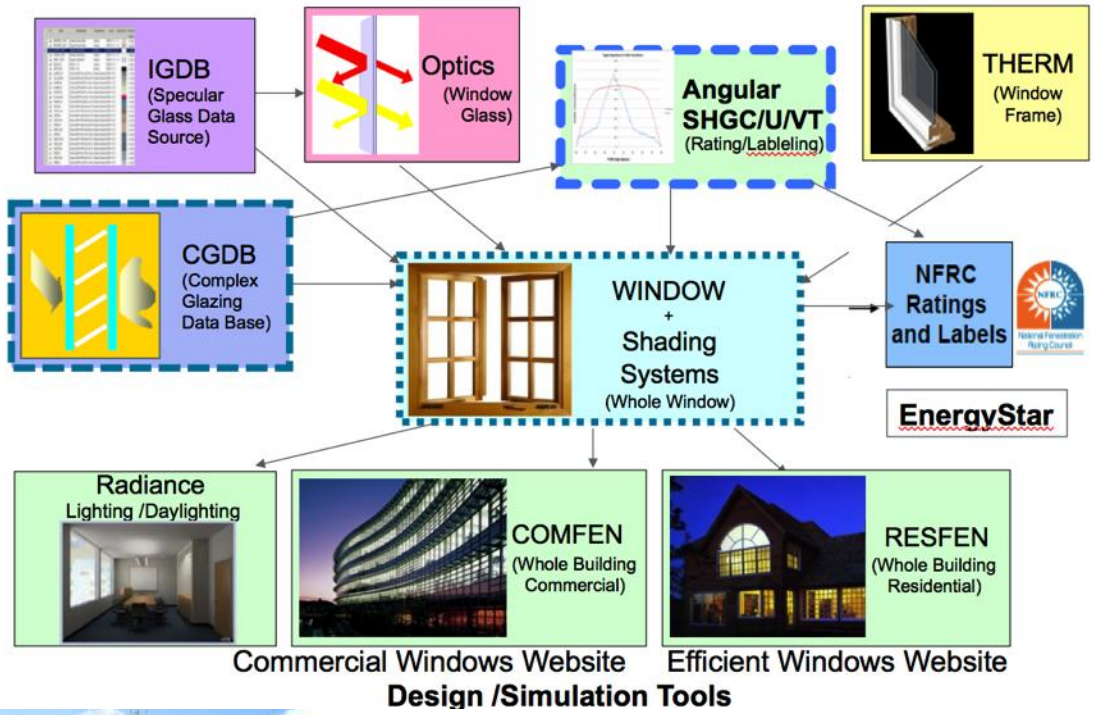


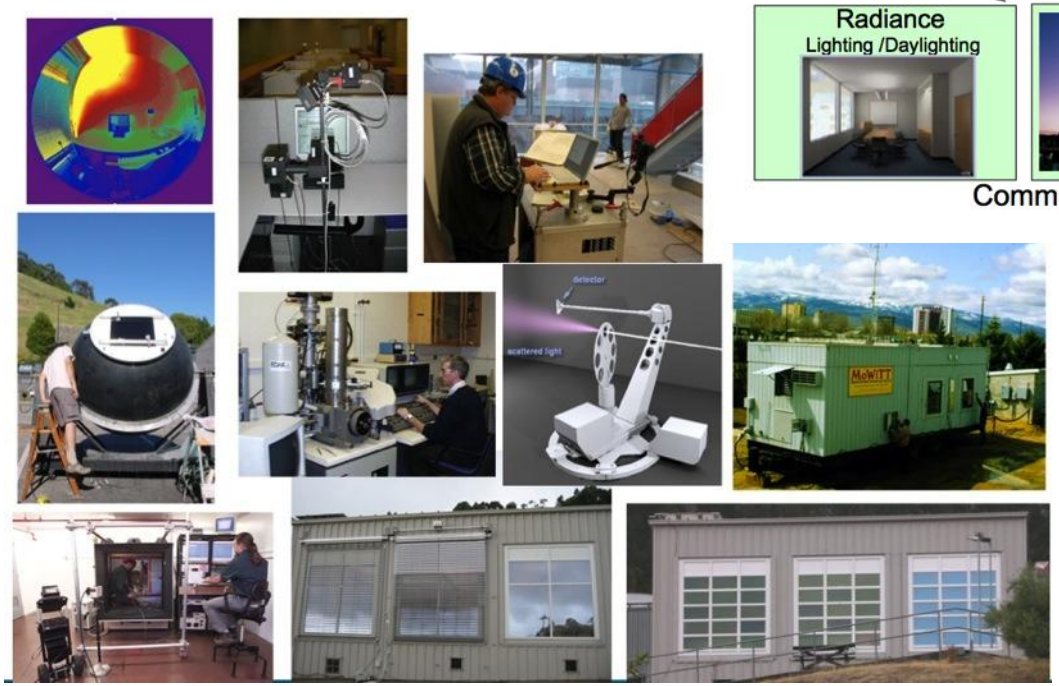




Approach: Decision Support Tools

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





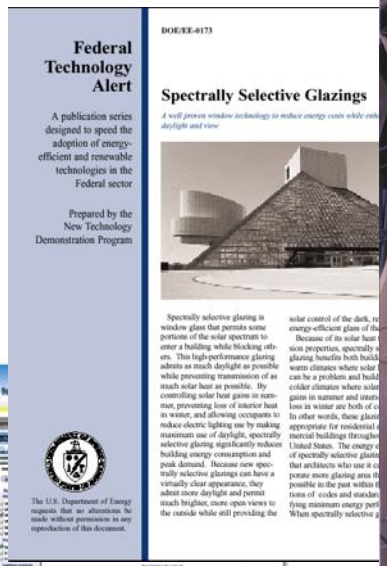
A fleet of integrated indoor and outdoor lab facilities and testbeds for measuring "properties" of window, shading systems, and validating software tools

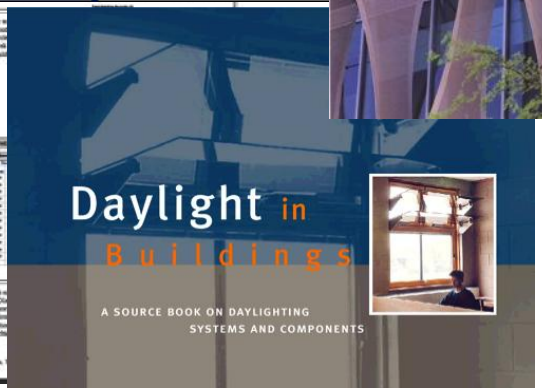
Approach: Tools (2)

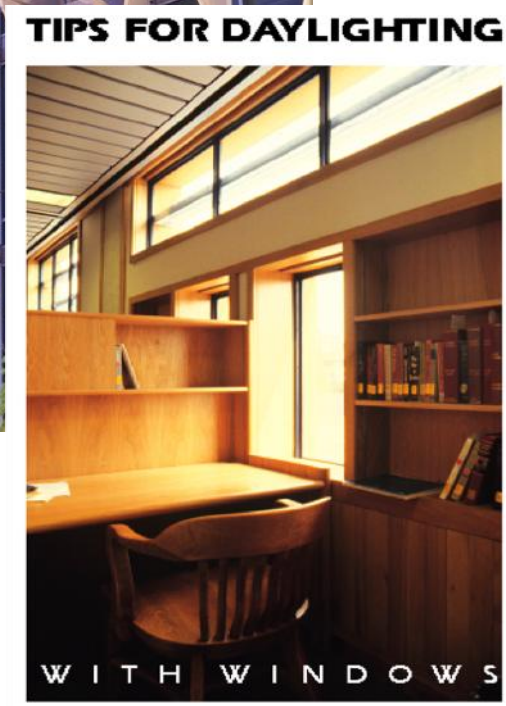
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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

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







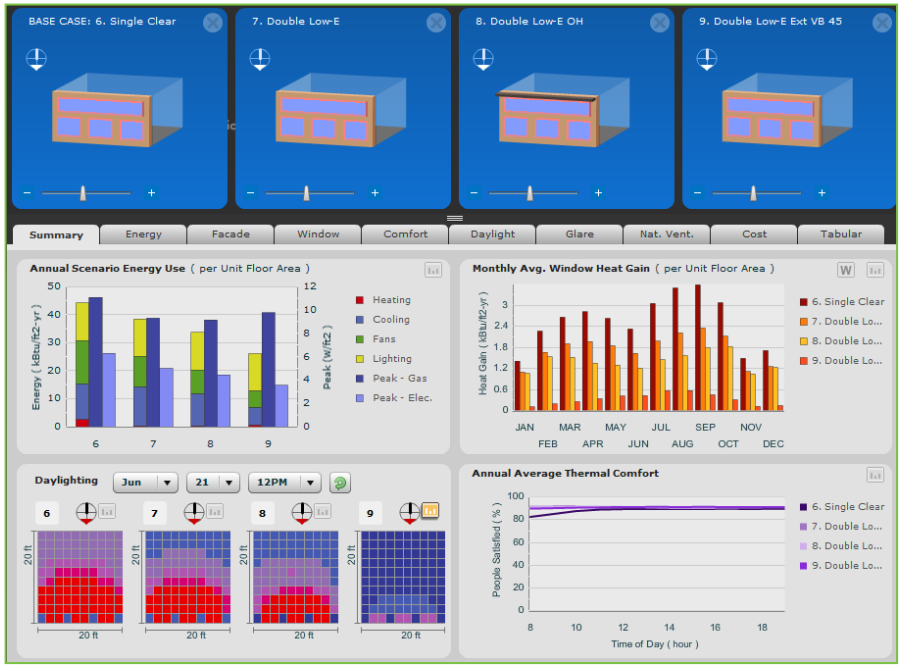
Approach: Tools (3)
COMFEN: Impact of Window Selection

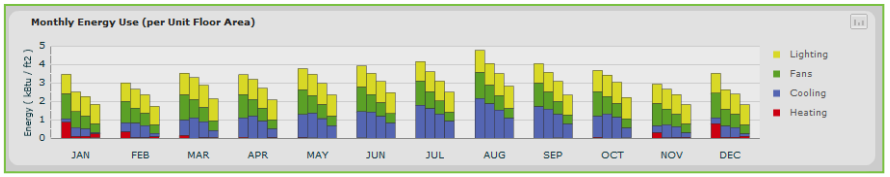
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

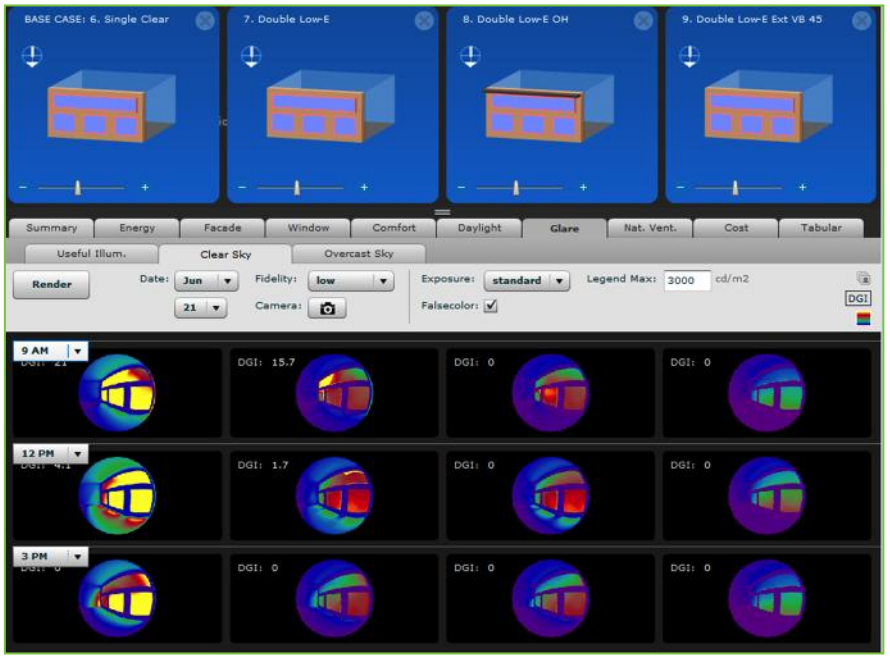
Early Design Scenario comparisons

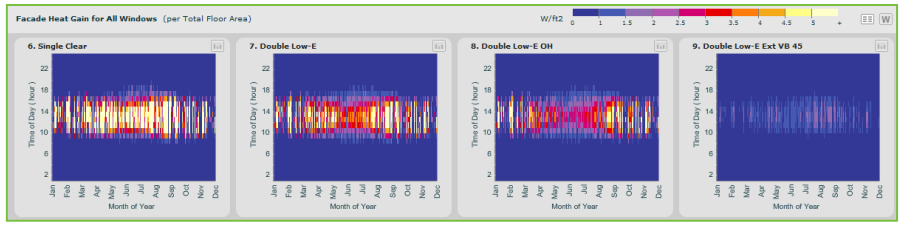
- Rapid analysis of façade options in early design development
- Easy to learn, easy to use
- Powerful tools under the hood (E+, Radiance, WINDOW 6)

Strong positive response from early adopters (architects / engineers)



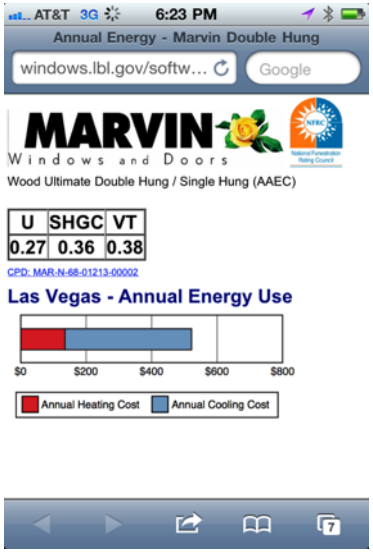


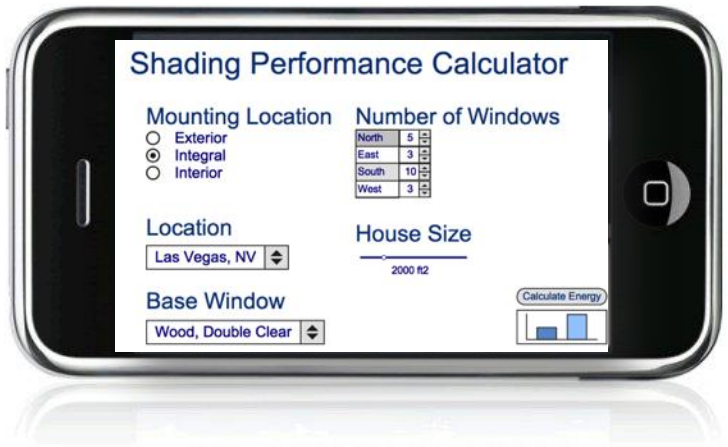




Approach: Tools – COMFEN ++

- 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

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

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

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	
WBS Number or Agreement Number	
Project Number	
Agreement Number	

Legend
Work completed
Active Task
Milestones & Deliverables (Original Plan)
Milestones & Deliverables (Actual)

Task / Event	FY2013 Q1 (Oct-Dec)	FY2013 Q2 (Jan-Mar)	FY2013 Q3 (Apr-Jun)	FY2013 Q4 (Jul-Sep)	FY2014 Q1 (Oct-Dec)	FY2014 Q2 (Jan-Mar)	FY2014 Q3 (Apr-Jun)	FY2014 Q4 (Jul-Sep)	FY2015 Q1 (Oct-Dec)	FY2015 Q2 (Jan-Mar)	FY2015 Q3 (Apr-Jun)	FY2015 Q4 (Jul-Sep)
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 Milestones TBD												
Field Test Updates Milestones TBD												
Technology Updates Milestones TBD												
Training and Education Programs Milestones TBD												

Project Budget

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)

Variances: 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

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

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

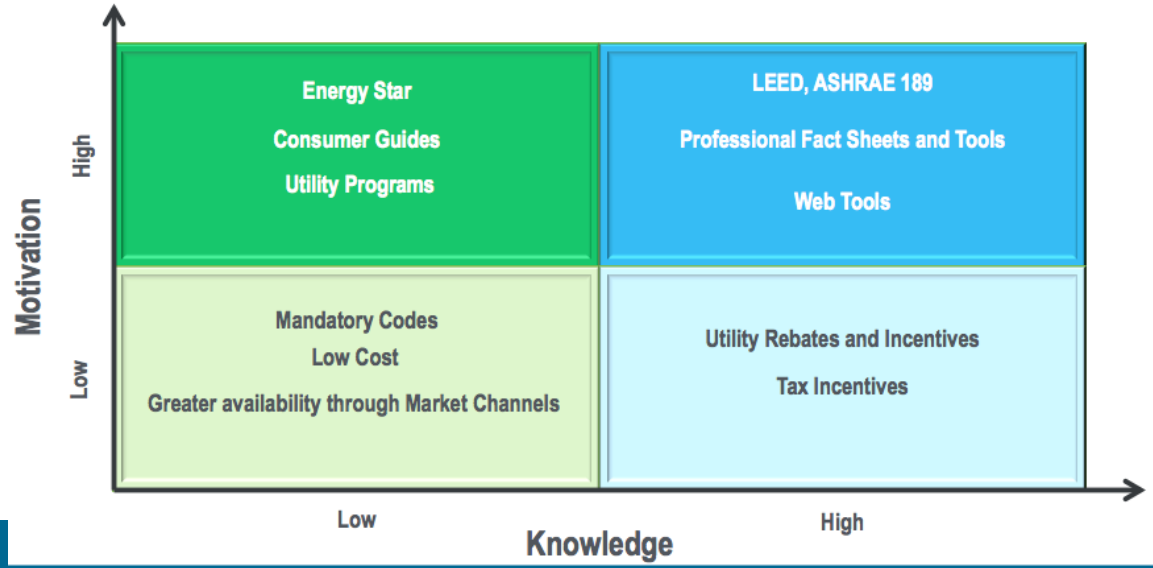
COMFEN Tool: http://windows.lbl.gov/software; **Website**: http://www.commercialwindows.org
"Train the Trainers": ex: Architectural firms

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



Next Steps and Future Plans

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

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