



Window and Envelope Solutions for
Today and Tomorrow

Montana Regional Workshop

July 27, 2011

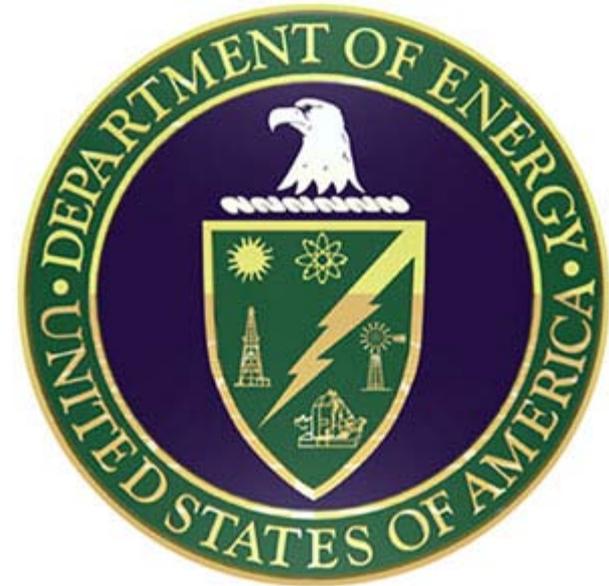
Goals of this presentation

- Show DOE purpose and planning for window-related programs
- Introduce a market transformation program that is increasing the availability of highly insulating windows and low-E storm windows
- Explain the benefits of these products and how they work



DOE and Windows

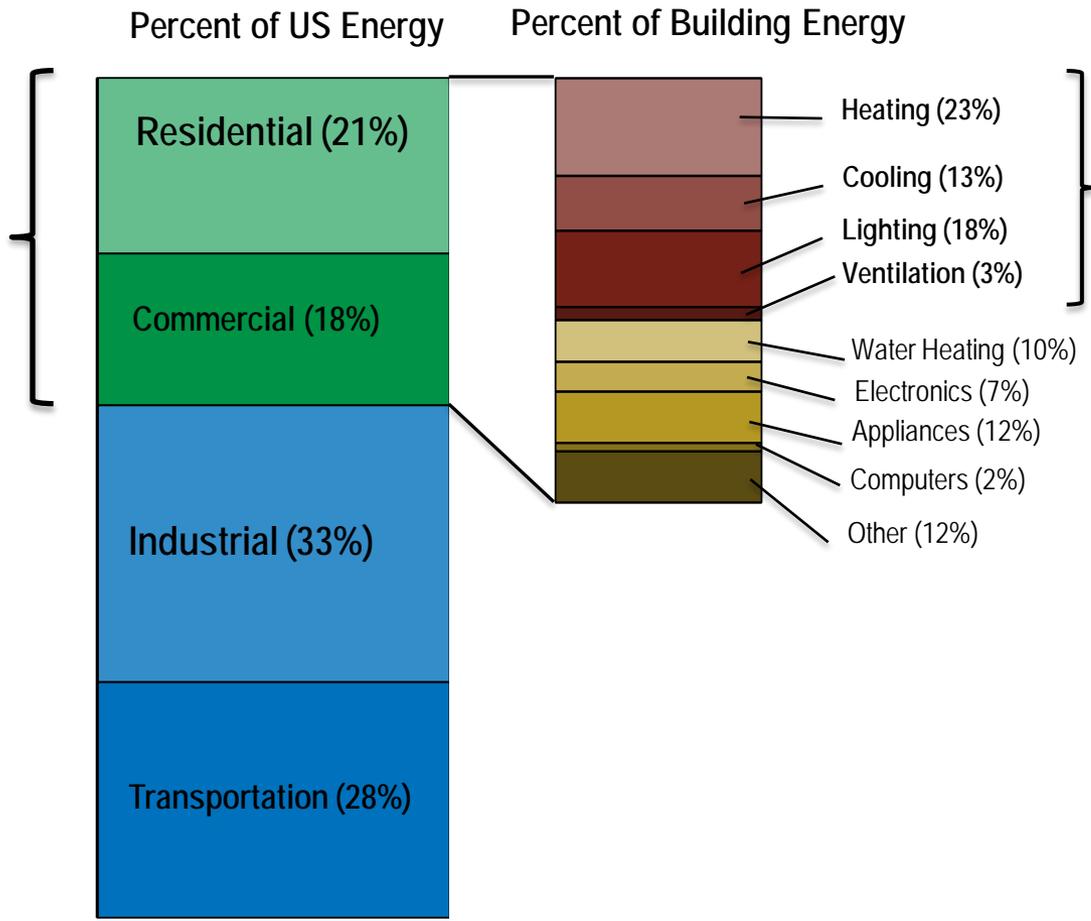
How the WVP program fits
into the big picture



Terry Mapes
Pacific Northwest National Laboratory

Why worry about windows?

Buildings are responsible for about 40% of US primary energy consumption



58% of the energy used in a building is impacted by windows. Almost 14% of the total energy in the US.

Total Building Envelope and Window R&D Budget

	Administration Budget Request	Enacted Appropriations	
FY05	5.0M Windows 0 Envelope	5.8M Windows 2.8M Envelope	
FY06	5.0M Windows 0 Envelope	*3.8M Windows (*earmarks) 2.9M Envelope	
FY07 & FY08	4.7M Windows 2.4M Envelopes	4.7M Windows 2.4M Envelope	
FY09	5.2M Windows 3.4M Envelopes	5.5 Windows 4.5 Envelope	
FY 10	10.5M Windows 5.5M Envelope	Core 10.5M Windows 5.5M Envelope	ARRA 25M
FY 11	10.5M Windows 8.5M Envelope	TBD – Not expected to exceed FY10 Continuing Resolution	
FY 12	25 M (9M BIPV)	TBD	



Integrated Programs to Reduce Price of Highly Insulating Windows

Technical Support

Building America demonstrations/ production housing for easy markets

High-performance specs in LEED for Homes & NGBS

Production Engineering RFP – 50%
Cost Share

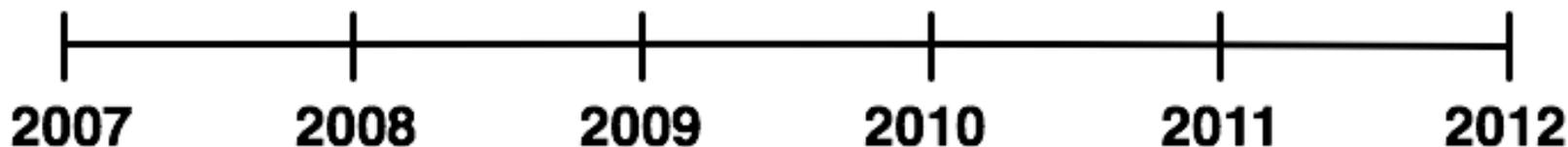
Technology Procurement/Volume Purchases

Develop
advanced utility
program specs

Support utility programs for
advanced windows

ENERGY STAR spec revision

ENERGY STAR Spec
Development

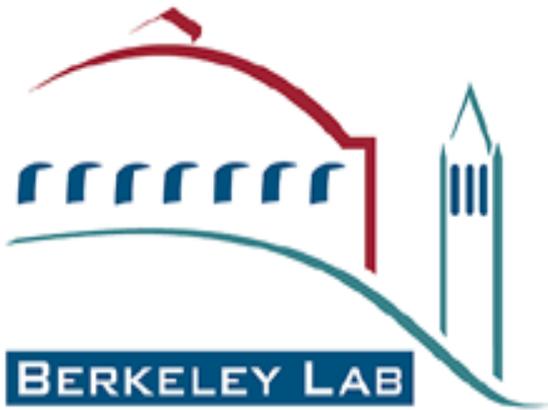


- **Highly Insulating Windows**
 - Goal is U-factor 0.10
 - Evaluate vacuum glazing
 - Advance dynamic glazing
- **Market-Based Approach**
 - Alternative to codes and standards
 - Technology specifications & procurement
 - Demonstrations



**Prototype – Concept Window
Highly Insulating and Dynamic
SHGC 0.04 – 0.34**

DOE Assists with Technical Support Activities

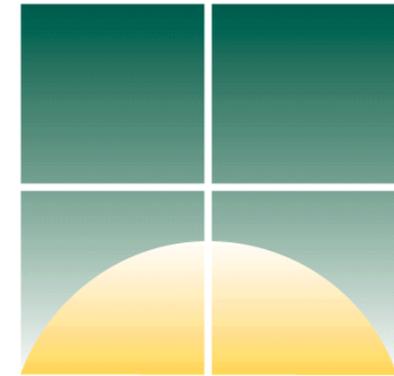


<http://windows.lbl.gov/software>



www.nfrc.org

Efficient Windows



Collaborative

www.efficientwindows.org

- Full range of software support tools, education materials and expansion to new product categories
- Continued financial support to assist industry in rating and promoting efficient products

Current Residential Windows Market

Home / Doors & Windows / Windows / Single Hung

Single Hung

PRICE

- \$50 - 100 (18)
- \$100 - 200 (15)

BRAND

- American Craftsman, an Andersen Company (16)
- JELD-WEN (9)
- TAFCO (6)
- TAFCO WINDOWS (2)

ENERGY STAR COMPLIANT

- Energy Star (25)

ECO OPTIONS

- Eco Options (21)

MATERIAL

33 Products

Sort By: Top Sell

Select up to 4 items to compare. COMPARE

American Craftsman, an Andersen Company 2301 Single Hung Vinyl Windows, 3/0 in. x 5/0 in. White with LowE3 Insulated Glass, Argon Model 2301

American Craftsman, an Andersen Company 2301 Single Hung Vinyl Windows, 3/0 in. x 5/0 in. White with LowE3 Insulated Glass, Argon Model 2301

Home Depot
Three largest window categories

Over 85% Energy Star compliant

Home / Doors & Windows / Windows / Double Hung

Double Hung

PRICE

- \$50 - 100 (1)
- \$100 - 200 (55)

PRO

- Pro (1)

STORM WINDOW

- No (32)

MORE WAYS TO SHOP

- Special Values
- Most Popular

56 Products

Sort By: Top Sell

Select up to 4 items to compare. COMPARE

American Craftsman, an Andersen Company 8500 Double Hung Vinyl Windows, 28 in. x 54 in. White, with LowE3 Insulated Model 8500

American Craftsman, an Andersen Company 3000 Double Hung Vinyl Windows, 2/4 in. x 3/2 in. White with LowE3 Insulated Model 3000

Product Comparison

Here are the products you have to compare:

	Model 3000	Model 8500	Model 3000	Model 8500
Remove Product	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Price	\$137.00/EA-Eac Ships FREE with \$249.00 Order	\$128.00/EA-Eac Ships FREE with \$249.00 Order	\$133.00/EA-Eac Ships FREE with \$249.00 Order	\$138.00/EA-Eac Ships FREE with \$249.00 Order
Manufacturer	American Craftsman, an Andersen Company			
Window Type	Double Hung	Double Hung	Double Hung	Double Hung
Collection Name	3000	8500	3000	8500
Color/Finish	White	White	White	White
Energy Star Compliant	Yes	Yes	Yes	Yes

R3 is now becoming the BASELINE

Home / Doors & Windows / Windows / Gliders

Gliders

PRICE

- Less than \$50 (1)
- \$50 - 100 (17)
- \$100 - 200 (17)

BRAND

- JELD-WEN (21)
- TAFCO (6)
- TAFCO WINDOWS (4)
- American Craftsman, an Andersen Company (4)

ENERGY STAR COMPLIANT

- Energy Star (25)

ECO OPTIONS

- Eco Options (20)

MATERIAL

35 Products

Sort By: Top Sell

Select up to 4 items to compare. COMPARE

JELD-WEN Vinyl Horizontal Sliding Window Low-e Glass 48 in. x 48 in. LH Model A92967

JELD-WEN Vinyl Horizontal Sliding Window Low-e Glass 48 in. x 36 in. LH Model A92965

Energy efficiency and the WVP Program products

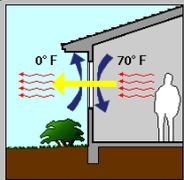
Highly Insulating Windows



Low-E Storm Windows

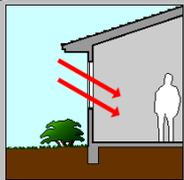
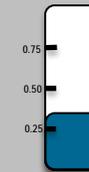


How do we measure how a window performs?



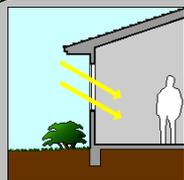
U-factor

Measures how insulating a window is
Lower = less heat loss



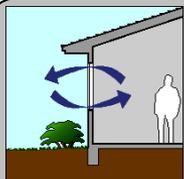
Solar Heat Gain Coefficient (SHGC)

Fraction of the solar energy that enters the window
Higher = more solar energy



Visible Transmittance (VT)

Fraction of visible light that enters the window
Higher = more daylight

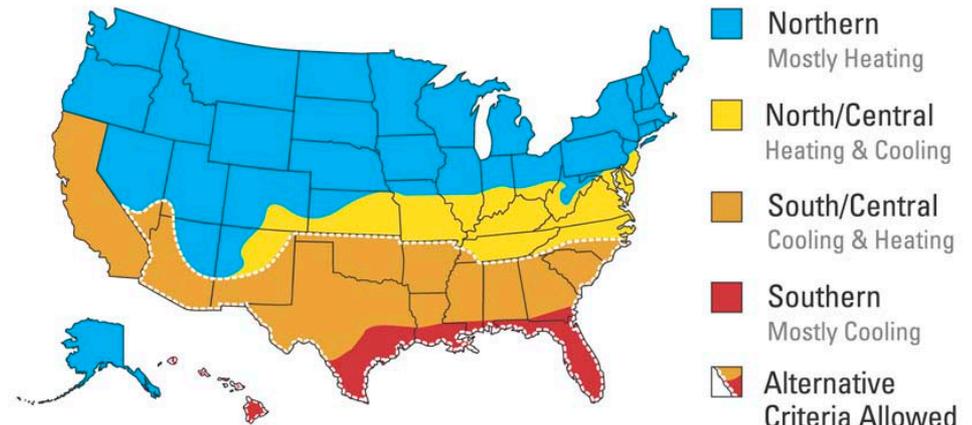
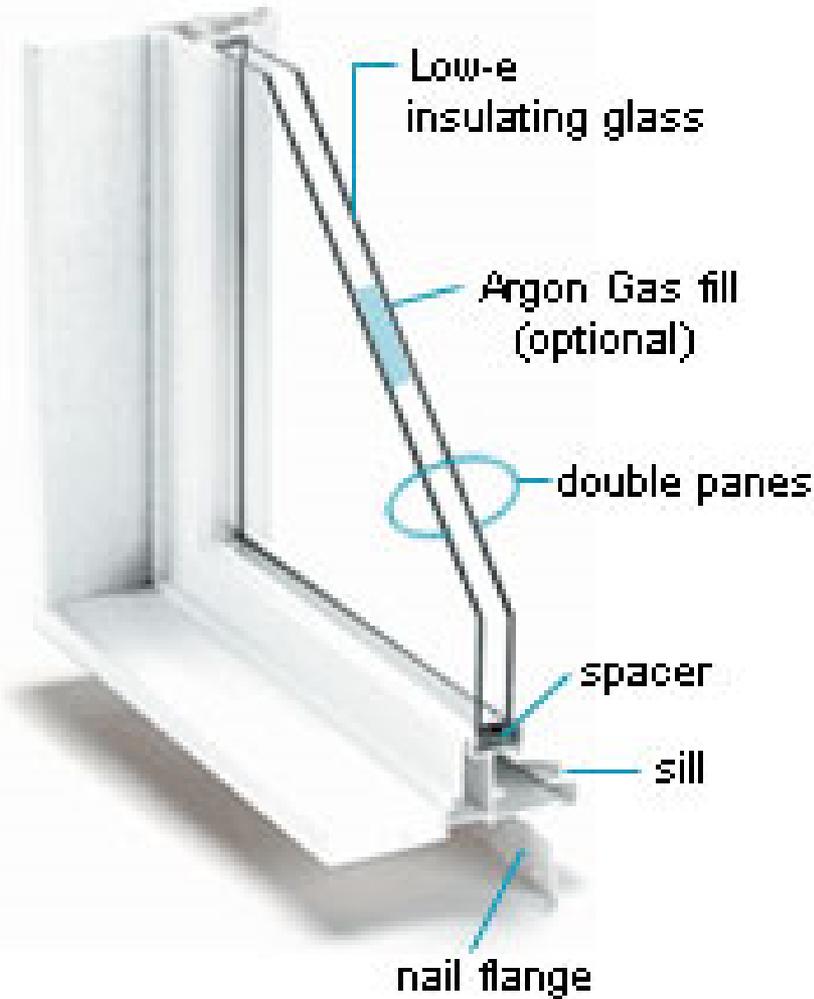


Air Leakage (AL)

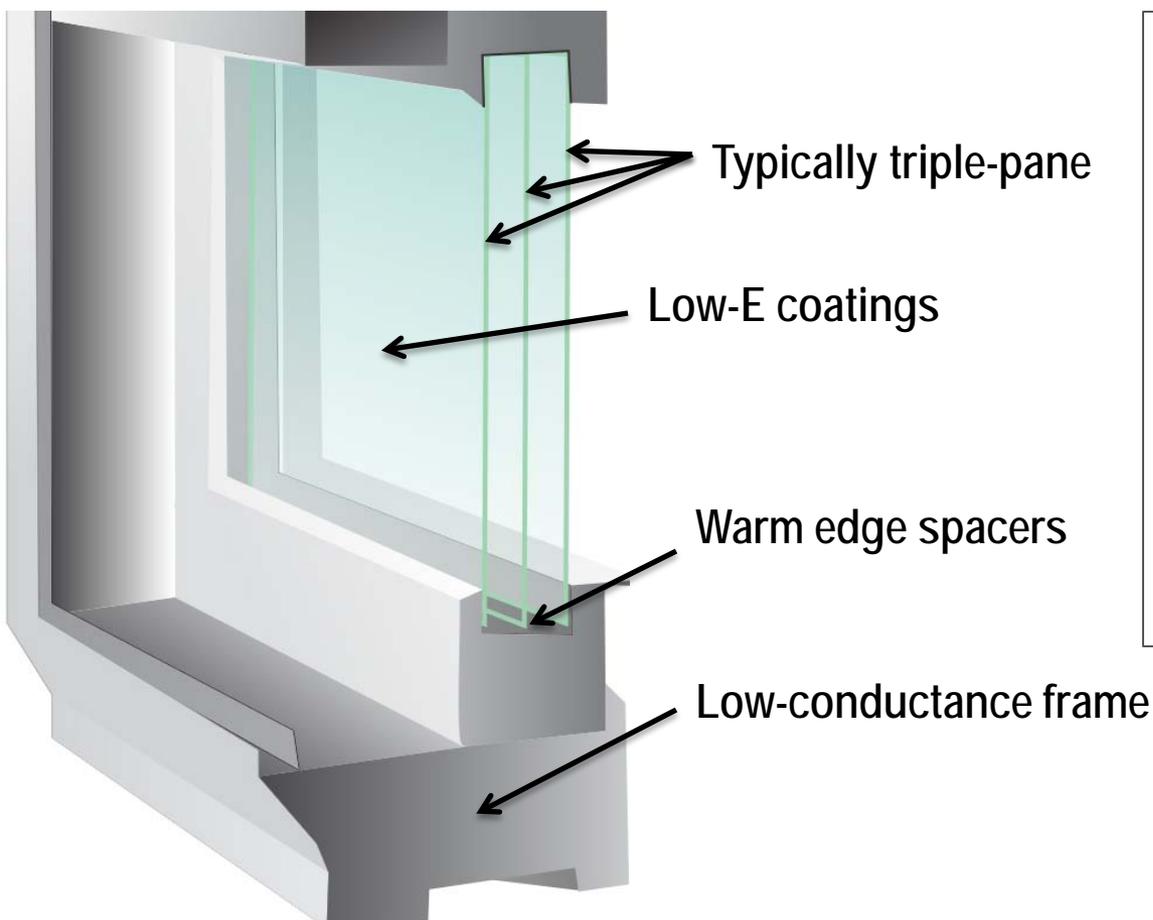
Volume of air that passes through the window when closed
Lower = less infiltration

Energy Star

- U-factor 0.30 (R-value ~ 3.3)
(Northern climate)
- Double pane
- One low-E coat
- Argon gas fill



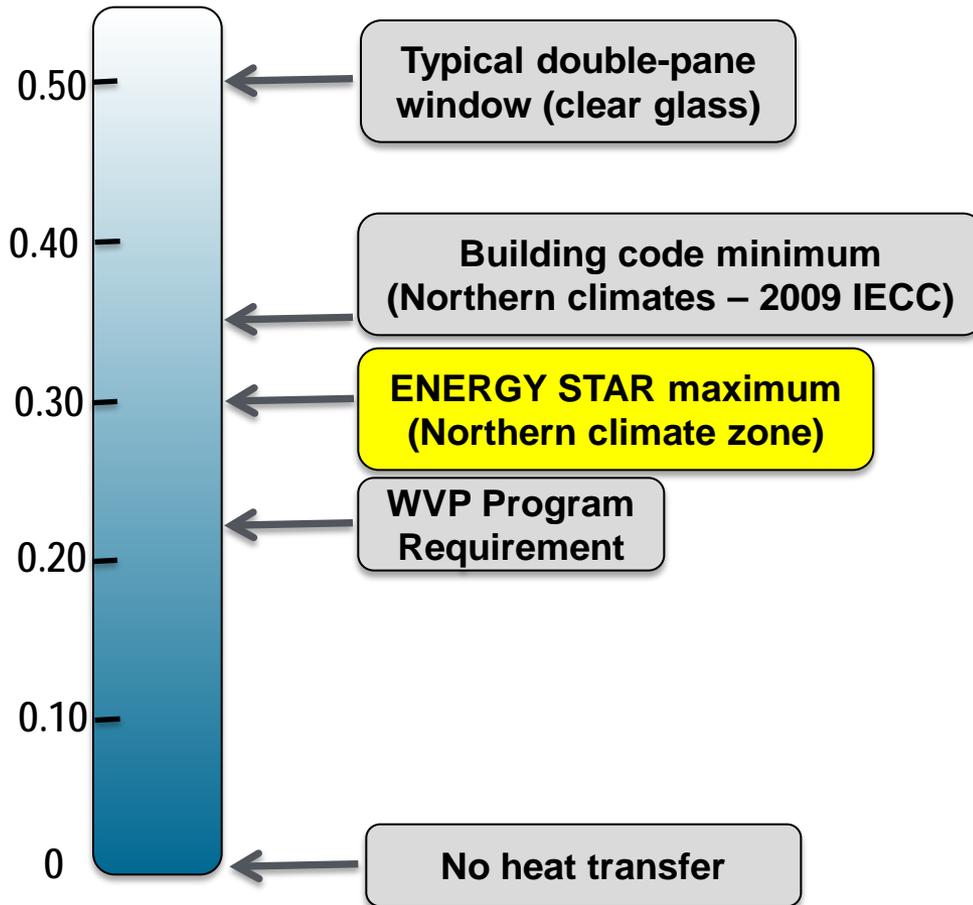
What makes a highly insulating window?



High Performance

- U-factor ≤ 0.22 (R-value ~ 4.5)
- Triple pane
- Two low-E coats
- Krypton gas fill
- Reduce heat loss 30-40% compared to Energy Star

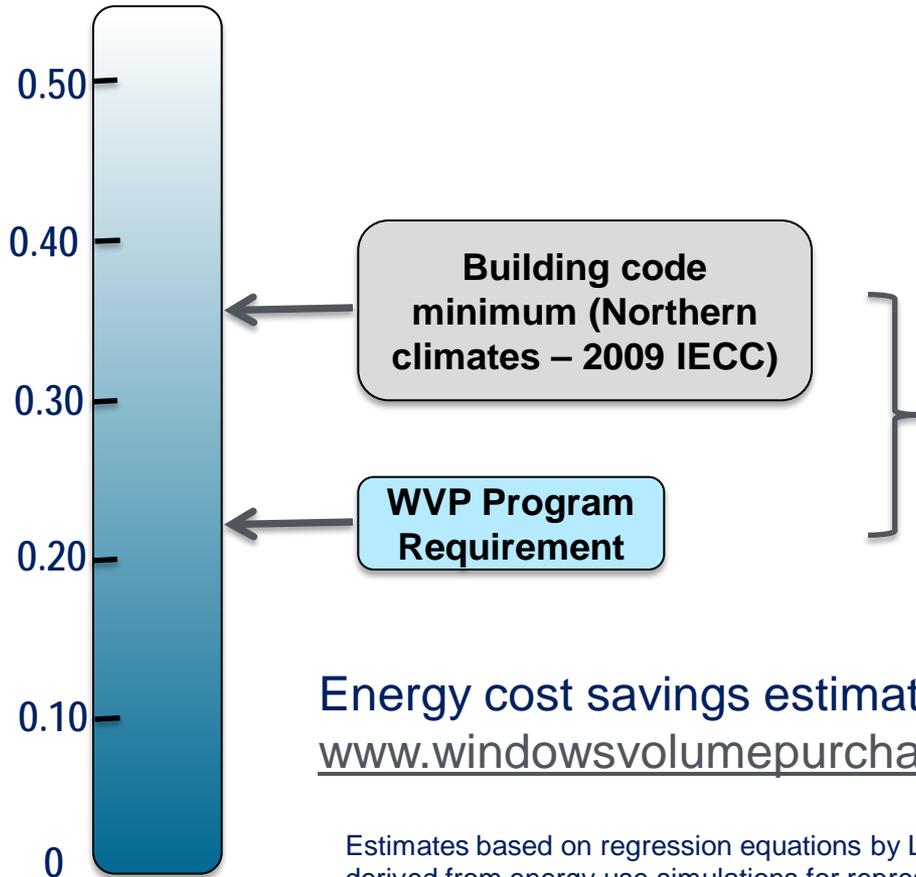
- Typical baseline and upgrade performance levels:



- In a phone survey of window distributors, $\frac{3}{4}$ of respondents indicated over 90% of retrofit window sales were ENERGY STAR

Estimated Energy Savings - Windows

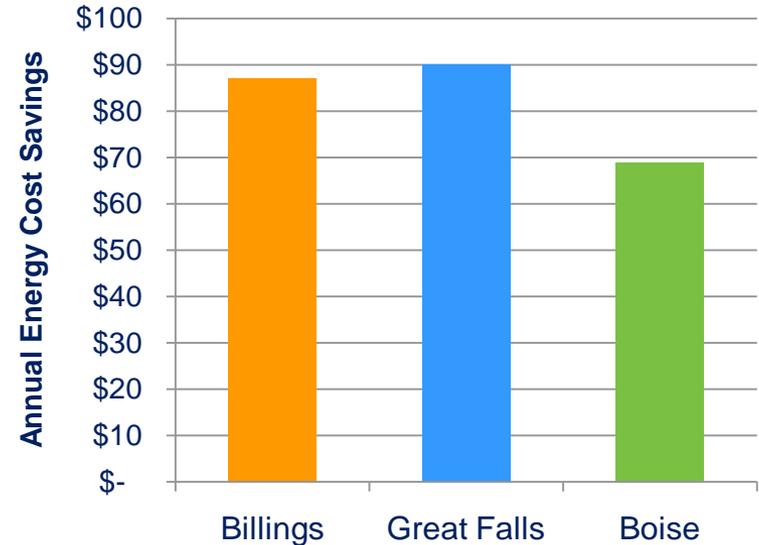
- High performance windows can provide significant energy cost savings



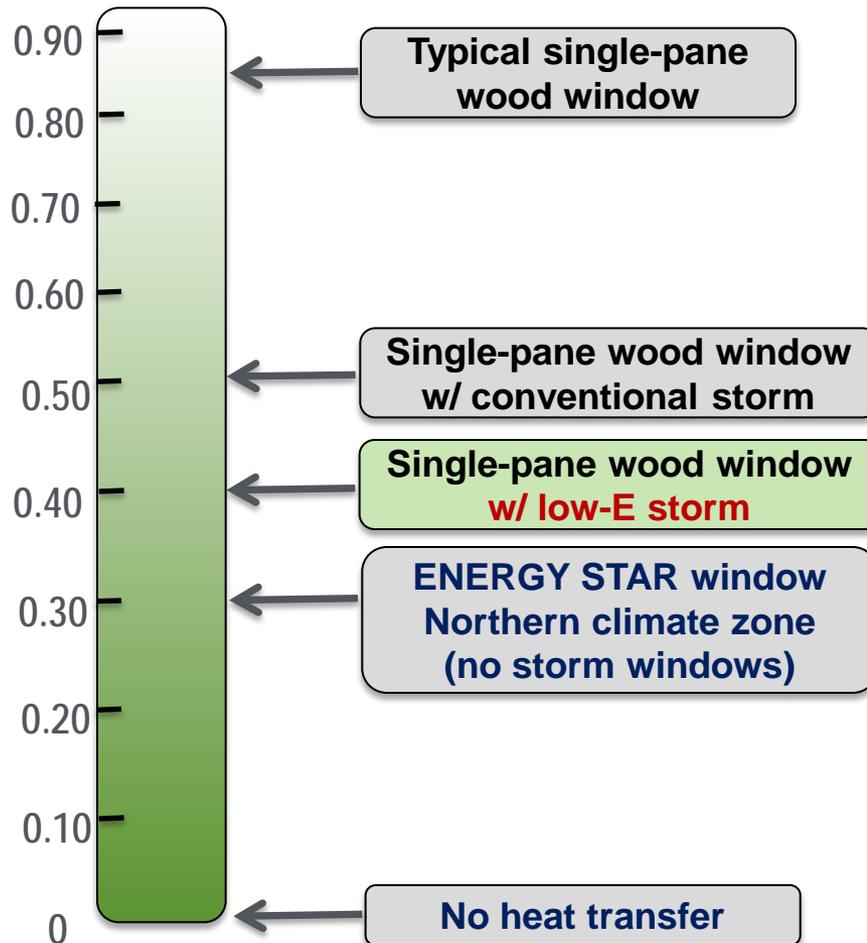
Energy cost savings estimator available for download at:
www.windowsvolumepurchase.org

Estimates based on regression equations by Lawrence Berkeley National Laboratory in 2008 derived from energy use simulations for representative single- and double-story homes in various U.S. locations. \$1.20/therm and \$0.12/kWh energy prices assumed.

Annual Energy Cost Savings
Typical new home, 2000 sq ft



- A low-E storm window is similar to a typical storm, but with the addition of a pyrolitic (“hard coat”) low-E coating

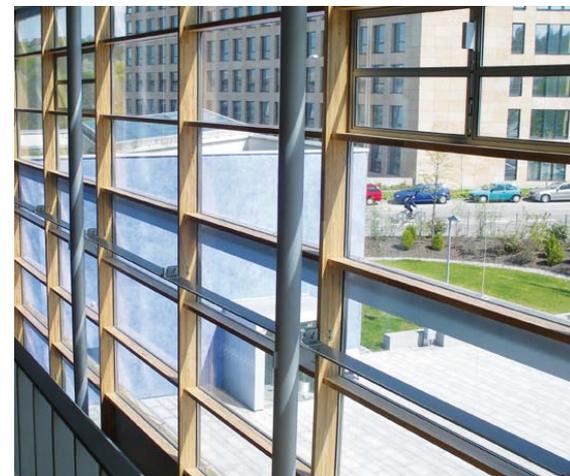


- Low-E coatings have been used for years on typical windows to improve their efficiency
- Use on storm windows is not as widespread – but very cost effective
- Installation costs are identical to standard storm windows

What is the WVP Program?

What is the WVP Program?

- Market transformation program
 - Goal is to increase the availability of high performance products
- Website lists many manufacturers of high performance windows
 - Interested buyers can find products
 - Easier comparison of prices
 - Educate consumers about these products
- WVP staff does marketing, education and outreach about the products



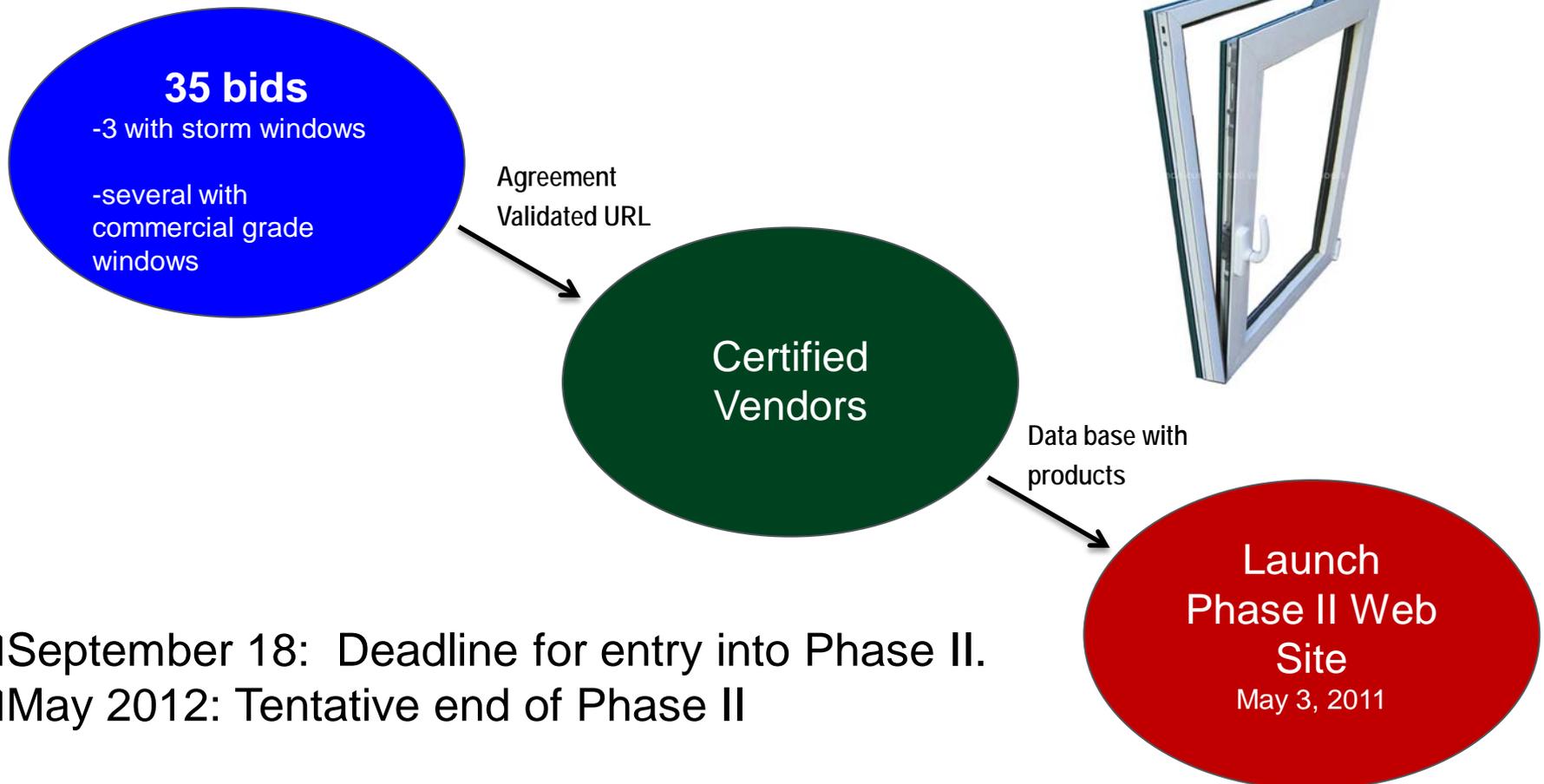
Phase I



Phase II



To date, we have more than 30 bids in Phase II and are processing these bids.



- ☐ September 18: Deadline for entry into Phase II.
- ☐ May 2012: Tentative end of Phase II

Final Windows and Low-E Storm Windows Specifications and Certifications

High Performance Windows

- U-factor: (R,LC) **0.20/0.22**
(CW) **0.24/0.27** (AW) **0.27/0.32**
- Air leakage: **≤ 0.30 cfm/ft²**
- Condensation Resistance: **≥50**
- Certifications: **NFRC/NAFS**
- Warranty (yr): **20 glass/10 non-glass**
- NAFS 05: **Performance Grade R25**



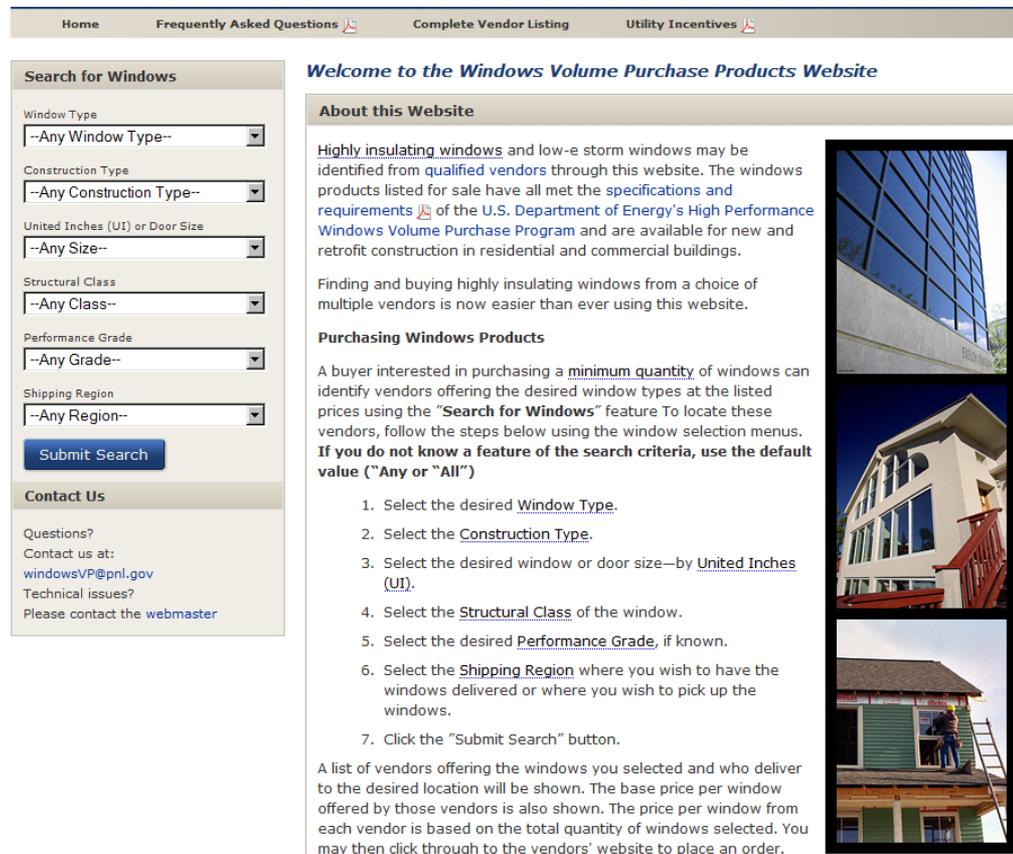
Low-e Storm Windows

- Emissivity: **<0.22**
- Certifications: **ANSI/AAMA 1002.10-93**
- Registry: **IGDB (LBNL database)**
- Warranty (yr): **10 glass/non-glass**



www.windowsvolumepurchase.org

- Optional bid request form
- Many homeowners are responding.
- Focus is now on contractors, builders, remodelers, institutions, and weatherization agencies.
- Sales through 03/11:
 - ~3,600 windows
 - ~\$900K in sales
- Phase II products: May 3, 2011



The screenshot shows the website's navigation bar with links for Home, Frequently Asked Questions, Complete Vendor Listing, and Utility Incentives. Below this is a search form titled "Search for Windows" with dropdown menus for Window Type, Construction Type, United Inches (UI) or Door Size, Structural Class, Performance Grade, and Shipping Region, followed by a "Submit Search" button. A "Contact Us" section provides an email address (windowsVP@pnl.gov) and a link to the webmaster. The main content area features a welcome message, an "About this Website" section, and a "Purchasing Windows Products" section with a 7-step guide. To the right, there are three images: a modern glass building, a house with a red staircase, and a worker installing a window on a house.

Home Frequently Asked Questions Complete Vendor Listing Utility Incentives

Welcome to the Windows Volume Purchase Products Website

About this Website

Highly insulating windows and low-e storm windows may be identified from qualified vendors through this website. The windows products listed for sale have all met the specifications and requirements of the U.S. Department of Energy's High Performance Windows Volume Purchase Program and are available for new and retrofit construction in residential and commercial buildings.

Finding and buying highly insulating windows from a choice of multiple vendors is now easier than ever using this website.

Purchasing Windows Products

A buyer interested in purchasing a minimum quantity of windows can identify vendors offering the desired window types at the listed prices using the "Search for Windows" feature. To locate these vendors, follow the steps below using the window selection menus. **If you do not know a feature of the search criteria, use the default value ("Any" or "All")**

1. Select the desired Window Type.
2. Select the Construction Type.
3. Select the desired window or door size—by United Inches (UI).
4. Select the Structural Class of the window.
5. Select the desired Performance Grade, if known.
6. Select the Shipping Region where you wish to have the windows delivered or where you wish to pick up the windows.
7. Click the "Submit Search" button.

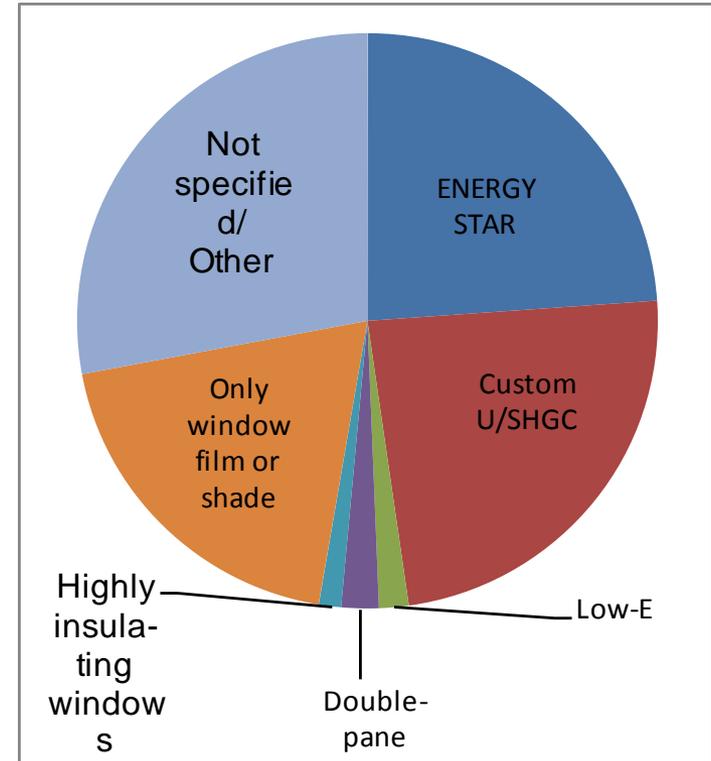
A list of vendors offering the windows you selected and who deliver to the desired location will be shown. The base price per window offered by those vendors is also shown. The price per window from each vendor is based on the total quantity of windows selected. You may then click through to the vendors' website to place an order.

WVP Website:

- Database format allows for filtering by desired criteria
 - Window type and size
 - Structural performance class and grade
 - Shipping Region
- Discrete manufacturers' prices shown for each product
- More complete data available for each product
- Descriptor boxes for each vendor (coming soon)
- Shipping regions more specific

Vendor	CT	SC	WT	UI	PG	Price	Shipping
Phy Gem	New	Residential	Double Hung	51-60	40	\$209	AL , AK , AZ , ...
Bonded Insulated Products	New	Residential	Double Hung	< 50	35	\$406	CT , DE , FL , ...
Gibax	All	Residential	Double Hung	120 +	70	\$4/UI	AL , AS , CT , ...
B.F. Bach	All	Residential	Double Hung	< 50	45	\$578	CT , DE , GA , ...
National Vinyl	New	Residential	Double Hung	111-120	35	\$387	CT , ME , MA , ...
Phy Gem	New	Residential	Double Hung	< 50	40	\$209	AL , AK , AZ , ...
Soft-Lite	Retrofit	Residential	Double Hung	91-100	50	\$889	AL , CO , CT , ...
Gorall	Retrofit	Residential	Double Hung	< 50	30	\$557	AL , AS , CO , ...
Jackets	New	Light Commercial	Double Hung	< 50	30	\$184	DE , NJ , NY
Season and Keller	All	Residential	Double Hung	120 +	45	\$4/UI	CT , DE , ME , ...
B.F. Bach	All	Residential	Double Hung	91-100	45	\$578	CT , DE , GA , ...
Phy Gem	New	Residential	Double Hung	120 +	35	\$2/UI	AL , AK , AZ , ...
National Vinyl	Retrofit	Residential	Double Hung	71-80	35	\$267	CT , ME , MA , ...
National Vinyl	Retrofit	Residential	Double Hung	101-110	35	\$332	CT , ME , MA , ...
Jeld-Wan	New	Residential	Double Hung	51-60	25	\$325	AL , AK , AZ , ...
Soft-Lite	Retrofit	Residential	Double Hung	71-80	35	\$689	AL , CO , CT , ...
Soft-Lite	Retrofit	Residential	Double Hung	101-110	35	\$554	AL , CO , CT , ...
Soft-Lite	Retrofit	Residential	Double Hung	120 +	55	\$13/VI	AL , CO , CT , ...

- Over 200 individual programs that provide rebates or low-interest loans for windows, window films, sun screens and/or storm windows.
- Most programs incentivize ENERGY STAR or similar, or shading only



List of utility programs available at: <http://www.efficientwindows.org/utilities.cfm>

How is the program being received?

Jason Bogovich, Energetics

“Advancing Window Technology, Saving Energy”



The Windows Volume Purchase Program offers a “Window of Savings” with new ways for consumers to save money and energy.

Potential Buyers, Marketers, and End-Users of High Performance Windows Share "Letters of Interest"

Over 20 letters of support from builders, weatherization agencies, non-profits and others

*"The Department of Energy's plan to create a market for new and emerging technologies will certainly have **profound energy savings impacts** for American families as well as for the **Nation's energy security.**" -CEDA*

Notable supporters:

Builders/Contractors (11 total)

- Building America Industrialized Housing Partnership (BAIHP)
- Clayton Homes .
- Palm Harbor Homes

Non-profits (7 total)

- Consortium for Energy Efficiency (CEE)
- Energy Trust of Oregon
- Habitat for Humanity
- Midwest Energy Efficiency Alliance (MEEA)

Weatherization (2)

- Community and Economic Development Association of Cook County, Illinois (CEDA)
- National Community Action Foundation (NCAF)

K-12 Schools (1)

Local/State (1)

- Commonwealth of Massachusetts

Financial Institutions (1)

Past Regional Workshops*

Midwest Regional Workshop

Chicago, IL

September 22, 2010

Key Partners: City of Chicago, State of Illinois, CEDA, and Midwest Energy Efficiency Alliance (MEEA)

Pacific Northwest Regional Workshop

Portland, OR

October 11, 2010

Key Partners: Energy Trust of Oregon, Northwest Natural,

Mid-Atlantic Regional Workshop

Philadelphia, PA

October 20, 2010

Key Partners: Energy Coordinating Agency,

Ohio Regional Workshop

Columbus, OH

April 26, 2011

Key Partners: State of Ohio (Ohio Energy Resources Division), The Ohio State University, The Ohio State University Extension, Ohio Home Builders Association, Mid-Ohio Regional Planning Commission, Green Energy Ohio, AEP Ohio, University Clean Energy Alliance of Ohio

Utah Regional Workshop

Clearfield, Utah

May 4, 2011

Key Partners: Intermountain Weatherization Training Center, State of Utah's Weatherization Program, Governor's Office, Utah Division of Facilities Construction and Management, Utah Valley University Construction Technologies, Utah Home Performance with Energy Star, Questar Gas ThermWise Rebate Program, Utah Clean Energy, UBEEES, Southwest Energy Efficiency Project, State Energy Program, Rocky Mountain Power



Past Webinars*

Alliance Webinar: Window Energy Efficiency Beyond Business as Usual

June 11, 2009

"Cost-Effective Triple Pane (R-5) and Low-e Storm Windows — Available Now."

DOE Webinar

June 22, 2010

Habitat for Humanity International Webinar

February 1, 2011

Youthbuild USA Webinar

April 12, 2011

Apartment and Office Building Association of Metropolitan Washington Webinar

June 7, 2011

National Association of Realtors Webinar

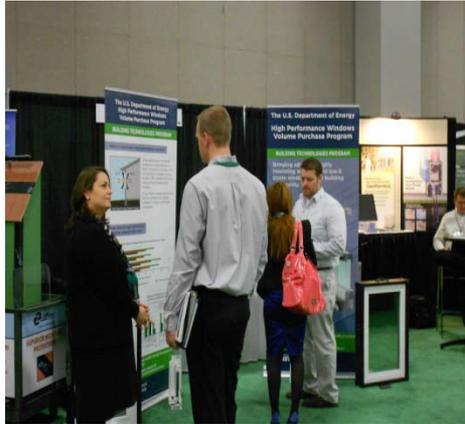
July 12, 2011

AESP Brown Bag Webinar

July 14, 2011



Past Conferences/Expos*



2009 Greenbuild Conference

Phoenix, AZ

2010 International Builders Show

Las Vegas, NV

2010 NEEP Conference

(Boston, MA)

2010 EEBA Conference

Portland, OR

2010 Greenbuild Conference

Chicago, IL

2011 Cincinnati Home and Garden Show

Cincinnati, OH

2011 Building Energy Conference

Boston, MA

2011 CT Home & Remodeling Show

Hartford, CT

2011 Habitat for Humanity International Conference

Atlanta, GA

2011 NAHB Greenbuilding Conference

Salt Lake City, UT

2011 BF Rich R-5 Event

Newark, DE

2011 Annual Utility Energy Forum

Asilomar, CA

2011 PHADA Conference

New Orleans, LA



Planned Marketing and Media Events



- **Conferences/trade shows***
 - **Gov Energy**
August 1
 - **Greenbuild**
October 4-7
 - **Glass Build**
September 12-14
 - **AAMA Fall Meeting**
Sept 25-28
 - **NFRC Fall Meeting**
Nov 7-10
 - **NAHB International Builder's Show**
February 8-11, 2012
- **Webinars***
 - **Rocky Mountain West Regional Webinar**
September 14
 - **American Hotel & Lodging Association Webinar**
September 21
 - **National Association of Homebuilders (TBD)**
 - **Commercial Building Energy Alliances (TBD)**
- **Workshops***
 - **Montana Regional Workshop**
July 27
 - **Colorado Regional Workshop**
October 4
 - **Potential Workshops: New York & Washington D.C.**

Updates to Pennsylvania's Weatherization Priority List

Low-E Storm Windows

- Selected as qualified measure with SIR values substantially higher than 1.
 - SIR values over single pane wood frame windows with a furnace at 80% efficiency: 1.4-2.2 (Average= 1.7)
 - SIR values over metal frame double pane windows with a furnace at 80% efficiency: 1.3-2.1 (Average= 1.6)

R-5 Windows

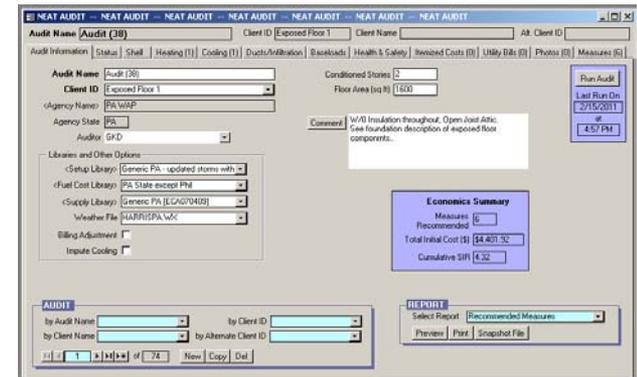
- “Necessary Replacement Scenario” SIR= 1.6-3.0 (Average= 2.3)
- Price point for high performance replacement: Installed Cost/ft² for SIR=1

City	Scranton	Harrisburg	Pittsburgh	Philadelphia
Single Pane Wood Frame	\$26.45	\$22.36	\$25.55	\$25.15
Metal Frame Double pane	\$25.45	\$21.50	\$24.55	\$24.35

Updating Pennsylvania's Weatherization Priority List

WVP Supporting State Weatherization

- Pennsylvania's state weatherization program priority list now includes low-E storm windows and highly insulating windows
 - WVP qualified windows recommended whenever windows must already be replaced
 - Low-E storm windows recommended as a cost effective measure when used over single pane or metal framed clear double pane windows.
- Changes to the priority list were due directly to the availability of products through the WVP program and through analysis provided by Energetics
 - Similar analysis can be requested by any state or similar program by contacting the WVP team



Graham Parker, CEM/PBEP
Pacific Northwest National Lab
graham.parker@pnl.gov
509-375-3805

Terry Mapes
Pacific Northwest National Lab
terry.mapes@pnl.gov
509-371-6745

Nils Petermann
Efficient Windows Collaborative
NPetermann@ase.org
202-530-2254

Neal Humphrey
Efficient Windows Collaborative
NHumphrey@ase.org
202-448-8760

Jason Bogovich
Energetics Incorporated
jbogovich@energetics.com
410-953-6257

Walt Zalis
Energetics Incorporated
wzalis@energetics.com
410-953-6256