

Building Technologies Program

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



Window and Envelope Solutions for
Today and Tomorrow

Rocky Mountain Builders Conference
Beaver Creek, CO
October 7, 2011

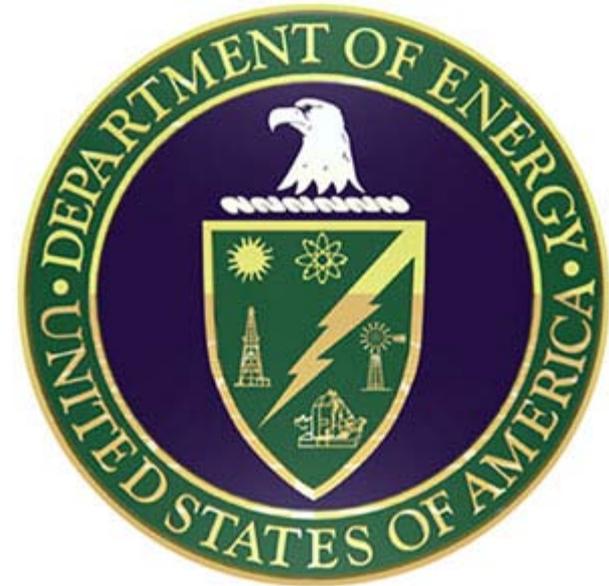
Goals of this presentation

- 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

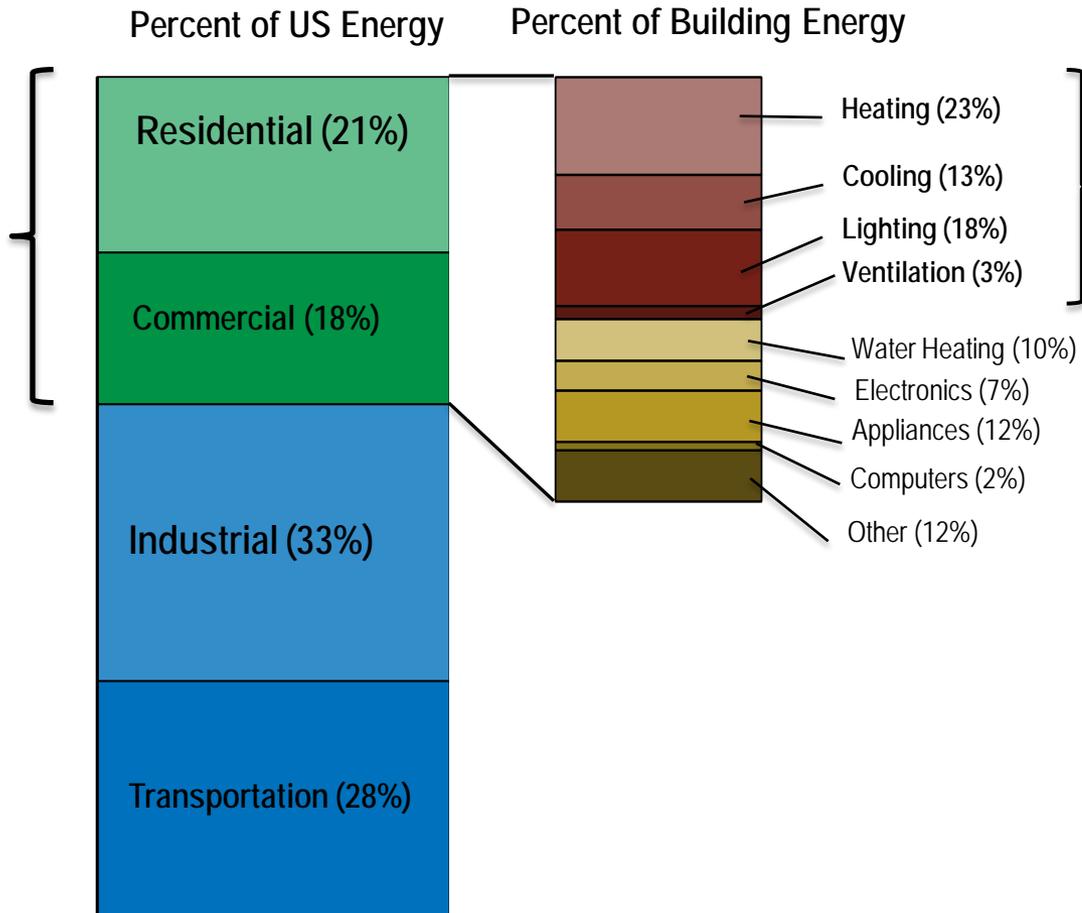


Terry Mapes
Pacific Northwest National Laboratory

Impact on US Energy Consumption

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.

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"/>
Image				
Price	\$137.00/EA-Eac	\$128.00/EA-Eac	\$133.00/EA-Eac	\$138.00/EA-Eac
Shipping	Ships FREE with \$249.00 Order	Ships FREE with \$249.00 Order	Ships FREE with \$249.00 Order	Ships FREE with \$249.00 Order
Description	American Craftsman, an Andersen Company 3000 Double Hung Vinyl Windows, 2/4 in. x 3/10 in. White with LowE3 Insulated	American Craftsman, an Andersen Company 8500 Double Hung Vinyl Windows, 28 in. x 46 in. White, with LowE3 Insulated	American Craftsman, an Andersen Company 3000 Double Hung Vinyl Windows, 2/4 in. x 3/2 in. White with LowE3 Insulated	American Craftsman, an Andersen Company 8500 Double Hung Vinyl Windows, 28 in. x 54 in. White, with LowE3 Insulated
Availability	Out Of Stock Online	Out Of Stock Online	Out Of Stock Online	Out Of Stock Online
Online Only	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Brand Name	American Craftsman, an Andersen Company	American Craftsman, an Andersen Company	American Craftsman, an Andersen Company	American Craftsman, an Andersen Company
Manufacturer	Silver Line Building Products Corp.	Silver Line Building Products Corp.	Silver Line Building Products Corp.	Silver Line Building Products Corp.
Window Type	Double Hung	Double Hung	Double Hung	Double Hung
Collection Name		8500		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

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

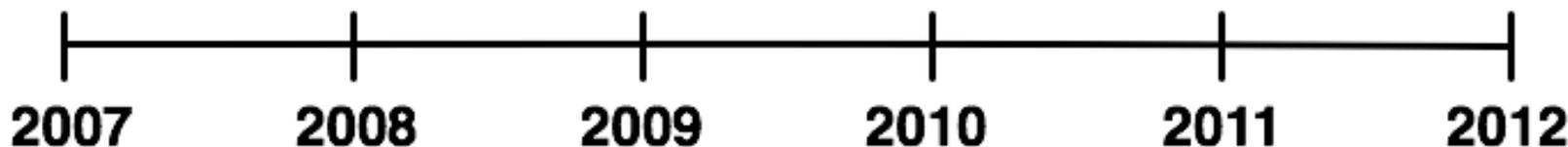
Technology Procurement/Volume Purchases

Develop
advanced utility
program specs

Support utility programs for
advanced windows

ENERGY STAR spec revision

ENERGY STAR Spec
Development

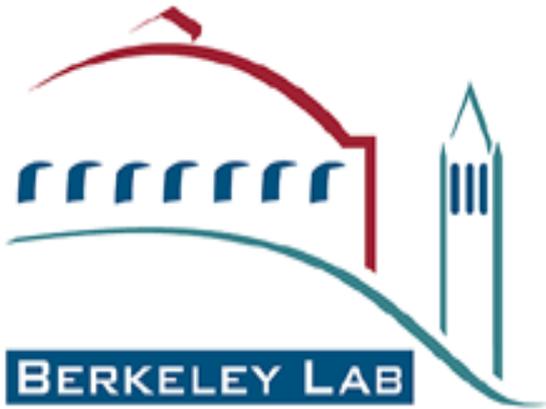


- **Highly Insulating Windows**
 - Goal is U-factor 0.10
 - Evaluate vacuum glazing
 - Advance dynamic glazing
- **Market-Based Approach**
 - Alternative to codes and standards
 - Technology specifications & procurement
 - Demonstrations



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

DOE Assists with Technical Support Activities

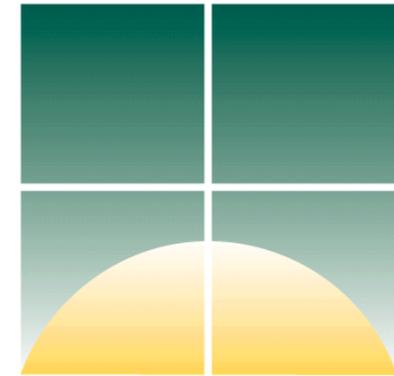


<http://windows.lbl.gov/software>



www.nfrc.org

Efficient Windows



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

Contact Information

P Marc LaFrance, CEM

Technology Development Manager

Building Technologies Program

Office of Energy Efficiency and Renewable Energy

US Department of Energy

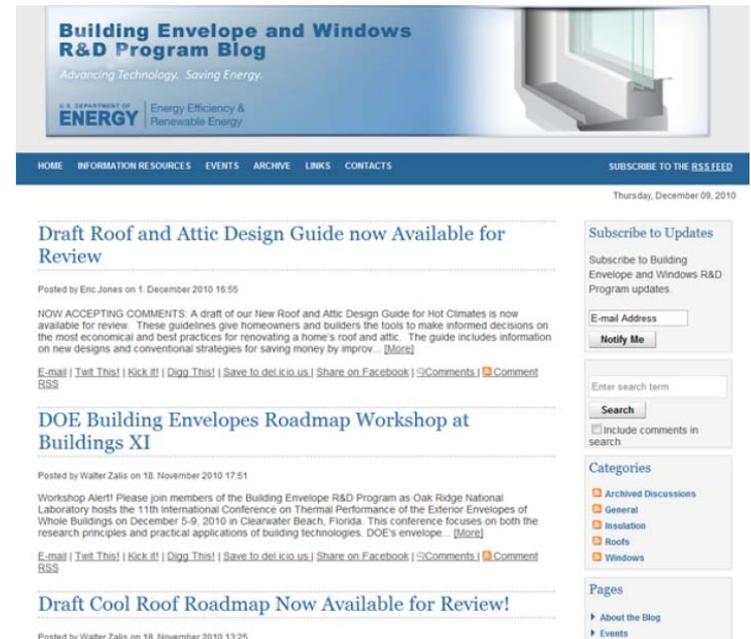
marc.lafrance@ee.doe.gov

1-202-586-9142

Fax 1-202-586-4617

www.eere.doe.gov

www.eereblogs.energy.gov/buildingenvelope

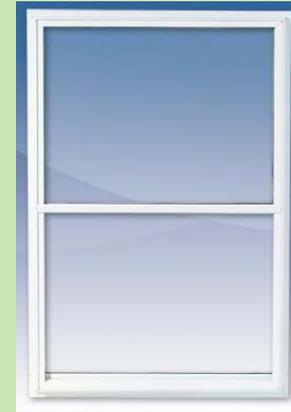


Energy efficiency and the WVP Program products

Highly Insulating Windows



Low-E Storm Windows

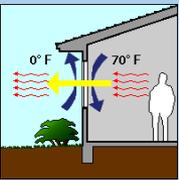


How do we know how a window performs?



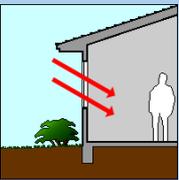
ENERGY STAR

Voluntary program with performance targets appropriate for each climate.



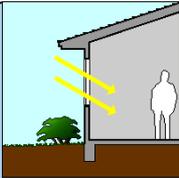
U-factor

Measures of insulating value
Lower = less heat loss



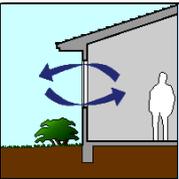
Solar Heat Gain Coefficient (SHGC)

Fraction of solar energy entering the window
Higher = more solar heat gain



Visible Transmittance (VT)

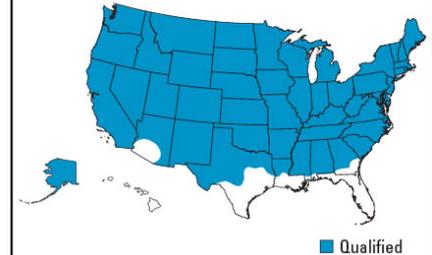
Fraction of visible light entering the window
Higher = more daylight



Air Leakage (AL)

Volume of air infiltration
Lower = less infiltration

ENERGY STAR® Qualified in Highlighted Regions



World's Best Window Co.

Millennium 2000+
Vinyl-Clad Wood Frame
Double Glazing • Argon Fill • Low E
Product Type: **Vertical Slider**

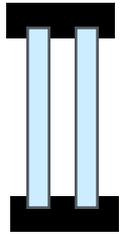
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.35	0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance	Air Leakage (U.S./I-P)
0.51	0.2

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org

*National Fenestration
Rating Council (NFRC) label*

Components of Efficient Windows

Ball-park impact on window properties

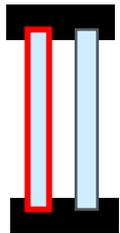


Conventional dual pane

U-factor: about 0.5



SHGC: about 0.55

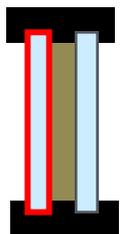


Dual pane **low-E**

U-factor: about 0.35



SHGC: 0.2-0.5 depending on low-E

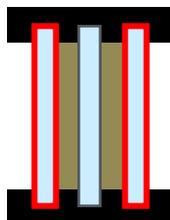


Dual pane low-E w/ **argon**

U-factor: about 0.3



SHGC: same as w/o argon



Triple pane 2x low-E w/ argon or krypton

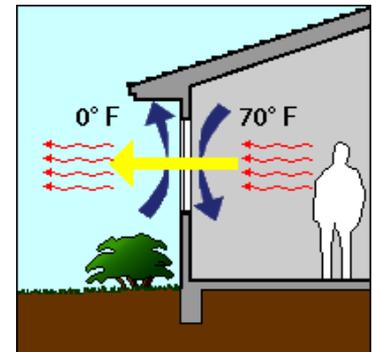
U-factor: about 0.2



SHGC: 0.15-0.4 depending on low-E

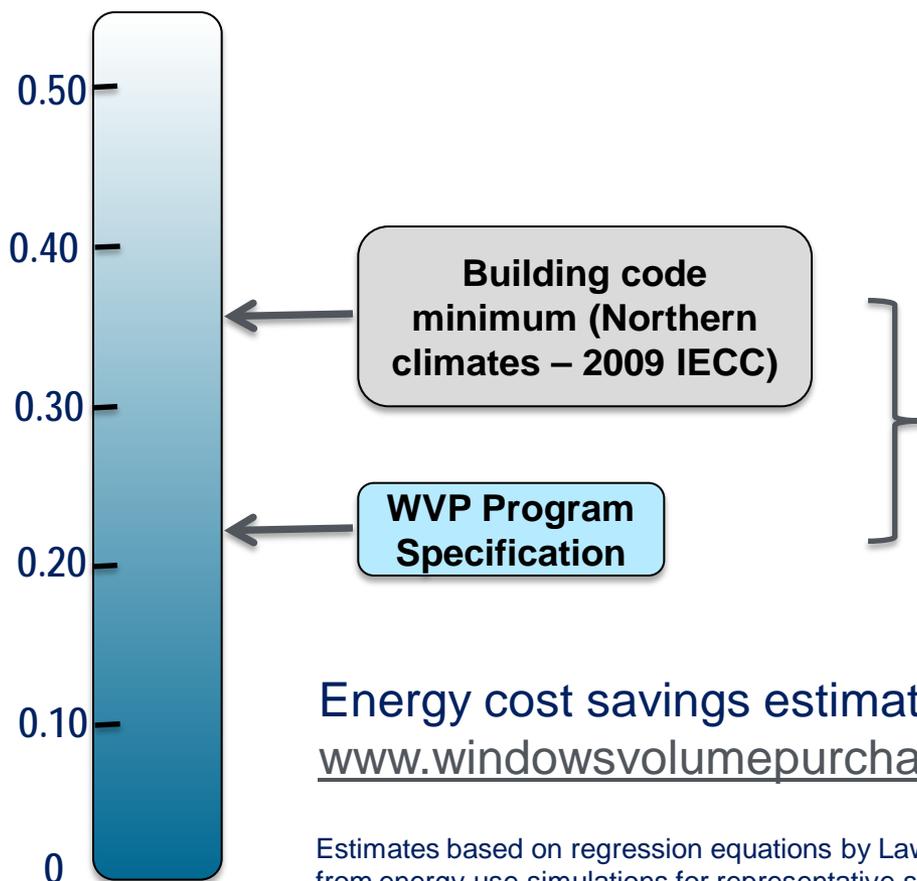


- U-factor units: Btu/hr-ft²-F
- Whole-window U-factors are generally higher than glass-only U-factors (frames and spacers more conductive than efficient glazing)
- Specify NFRC whole-window U-factor
- For general reference: R-value is inverse of U-factor
 - e.g. if $U = 0.2$, then $R = 1/0.2 = 5$
 - But: test conditions differ between windows and walls, so no direct equivalence to wall R-value



Estimated Energy Savings – High Performance Windows

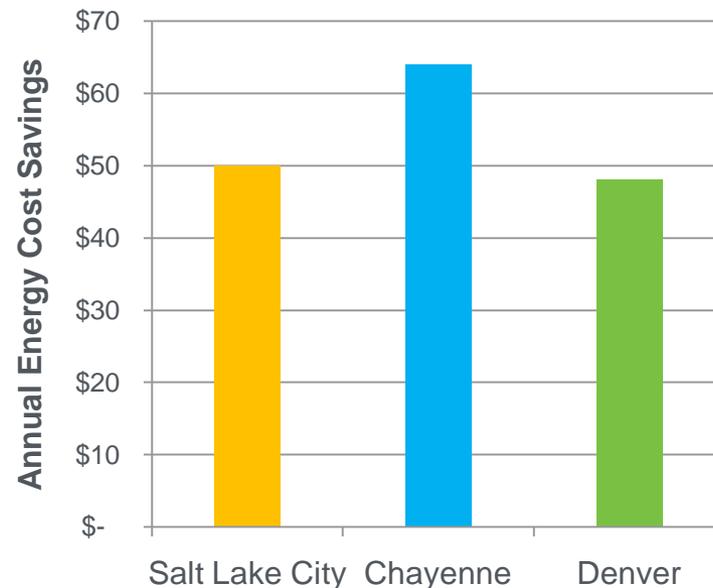
Savings depend on climate,
building type and energy prices



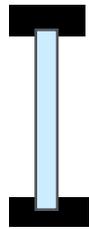
Energy cost savings estimator available for download at:
www.windowsvolumepurchase.org

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. \$0.83-\$1.28/therm and \$0.07-\$0.10/kWh energy prices assumed (dependent on location).

Annual Energy Cost Savings
Typical new home, 2250 sq ft

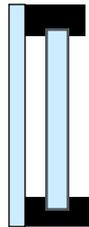


Estimated Energy Savings – Low-E Storm Windows



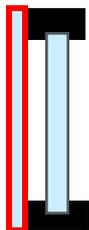
Single pane

U-factor: about 0.85



Single pane + storm window

U-factor: about 0.5

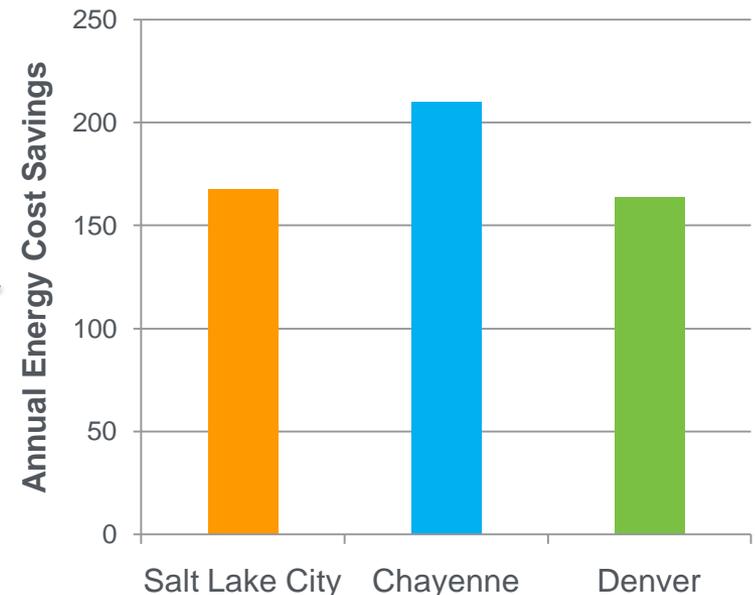


Single pane + low-E storm

U-factor: about 0.4



Annual Energy Cost Savings
Typical Existing Home, 2000 ft²



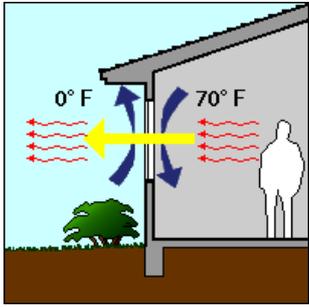
Energy cost savings estimator available for download at:
www.windowsvolumepurchase.org

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. \$0.83-\$1.28/therm and \$0.07-\$0.10/kWh energy prices assumed (dependent on location).

Fact sheets about low-E storm windows, window film, awnings, insulating shades, etc.

- Info about performance
- Tips and cautions
- Authors: LBNL and Building Green

<http://www.windowattachments.org>

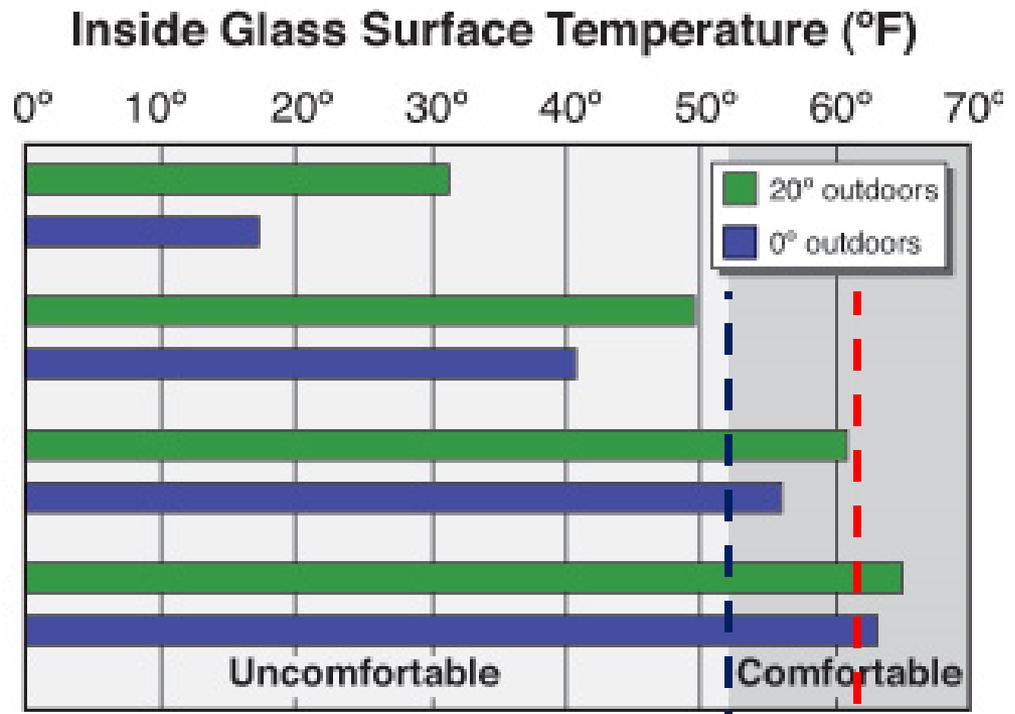


Single pane (U ~0.85)

Dual pane (U ~0.50)

Dual pane low-E, gas fill (U ~0.35)

Triple pane low-E, gas fill, insulated frame (U ~0.20)



Guidance provided by the PassivHaus Standard and ISO 7730:

- If window surface temperature is no more than 5-9°F below average room temperature, heating registers near windows are not needed.

with heat near windows

without heat near windows

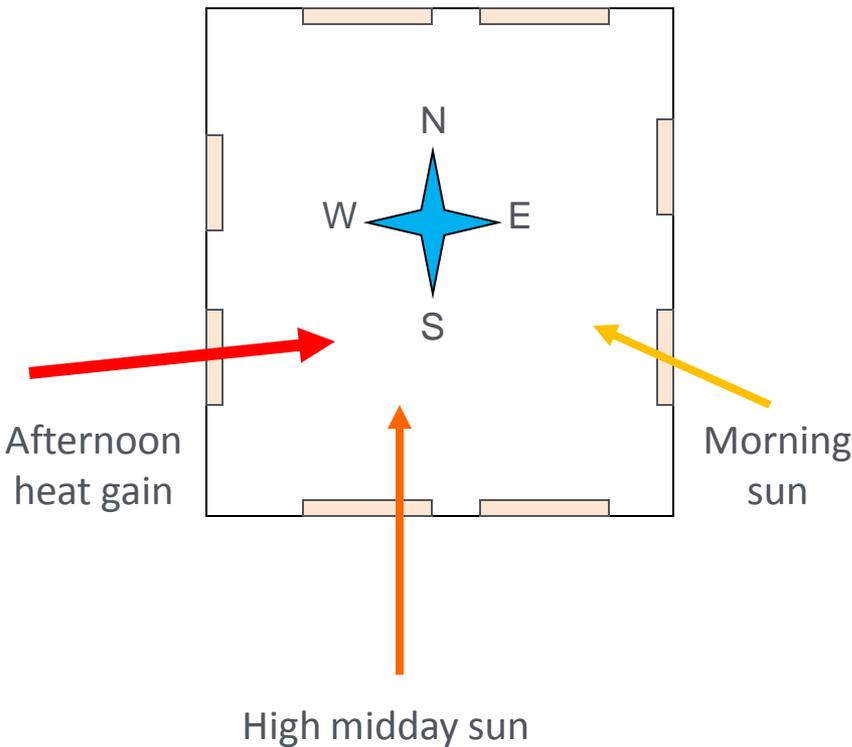
Wisdom Way Solar Village, Massachusetts

- \$7,000 incremental cost for high-performance envelope
 - including \$1,500 for U-factor 0.18 windows
- \$4,500 mechanical system cost savings
- Up to \$1,000 annual heating cost savings from envelope improvements and south-facing orientation

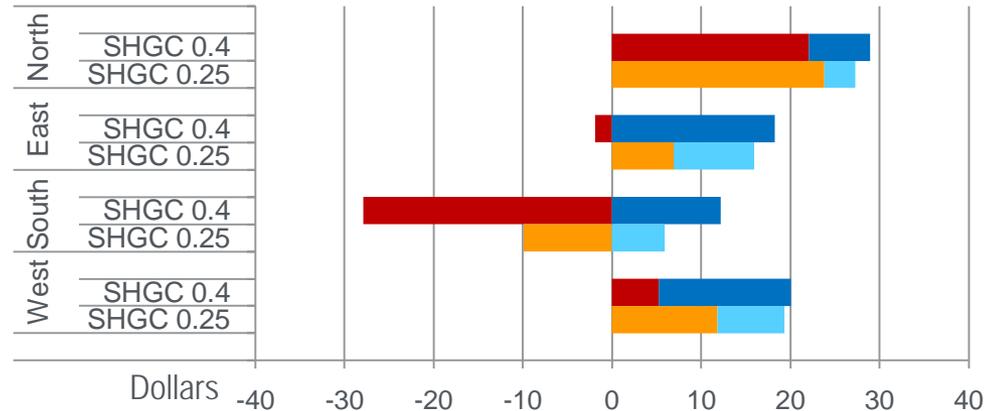


Source: Rural Development Inc.

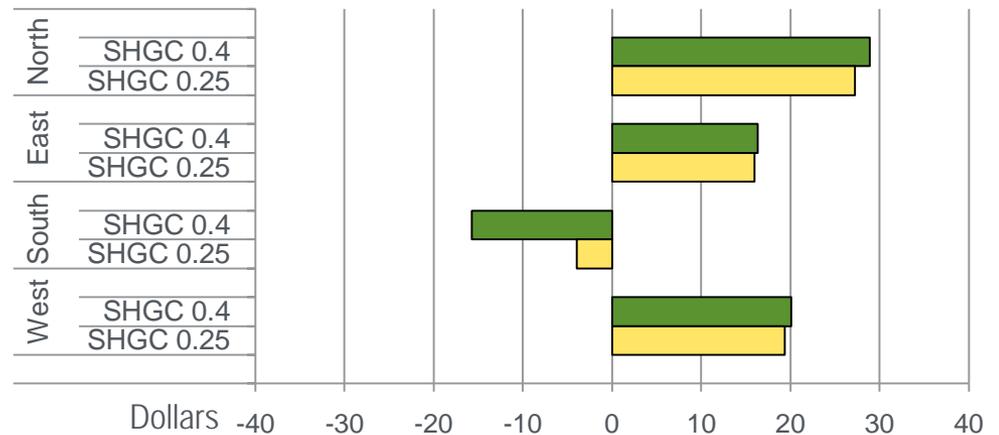
Solar Heat Gain: Impact by Orientation



Heating & Cooling Cost Due to Windows - Denver

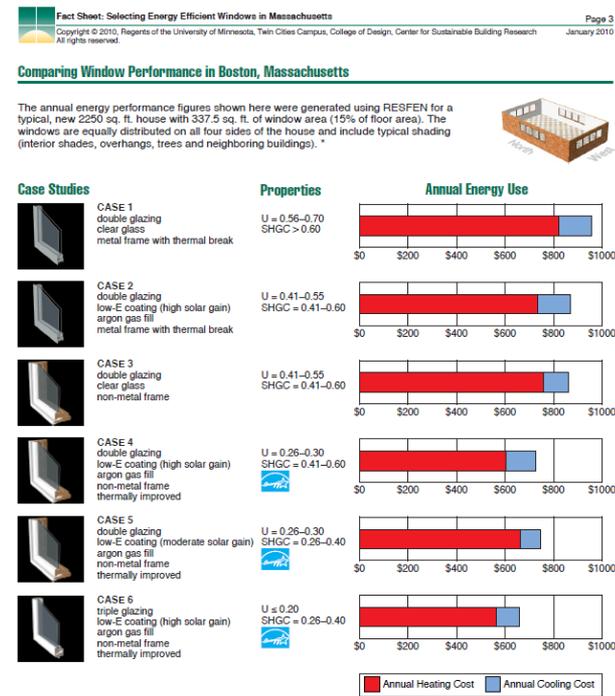


Total Energy Cost Due to Windows - Denver



Simulated with RESFEN by Lawrence Berkeley National Laboratory. Costs are for 90 sq ft of windows on each side. \$0.83/therm of natural gas for heating, \$0.10/kWh for cooling.

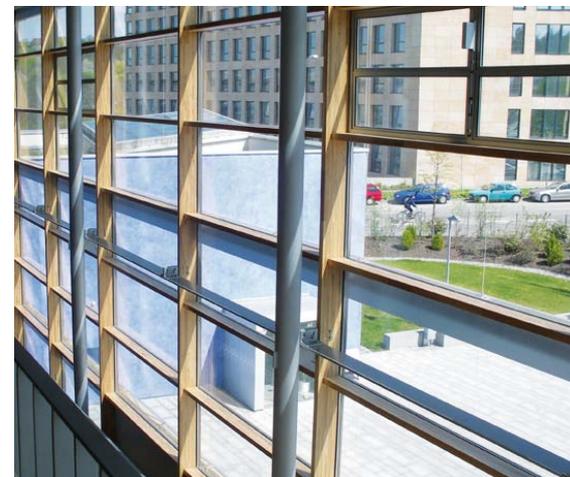
- Fact sheets and Window Selection Tool with pre-run simulations assuming typical houses:
www.efficientwindows.org
- RESFEN by Lawrence Berkeley National Laboratory
– free window energy simulation tool:
www.efficientwindows.org/resfen.cfm
- Contact us at ewc@ase.org



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



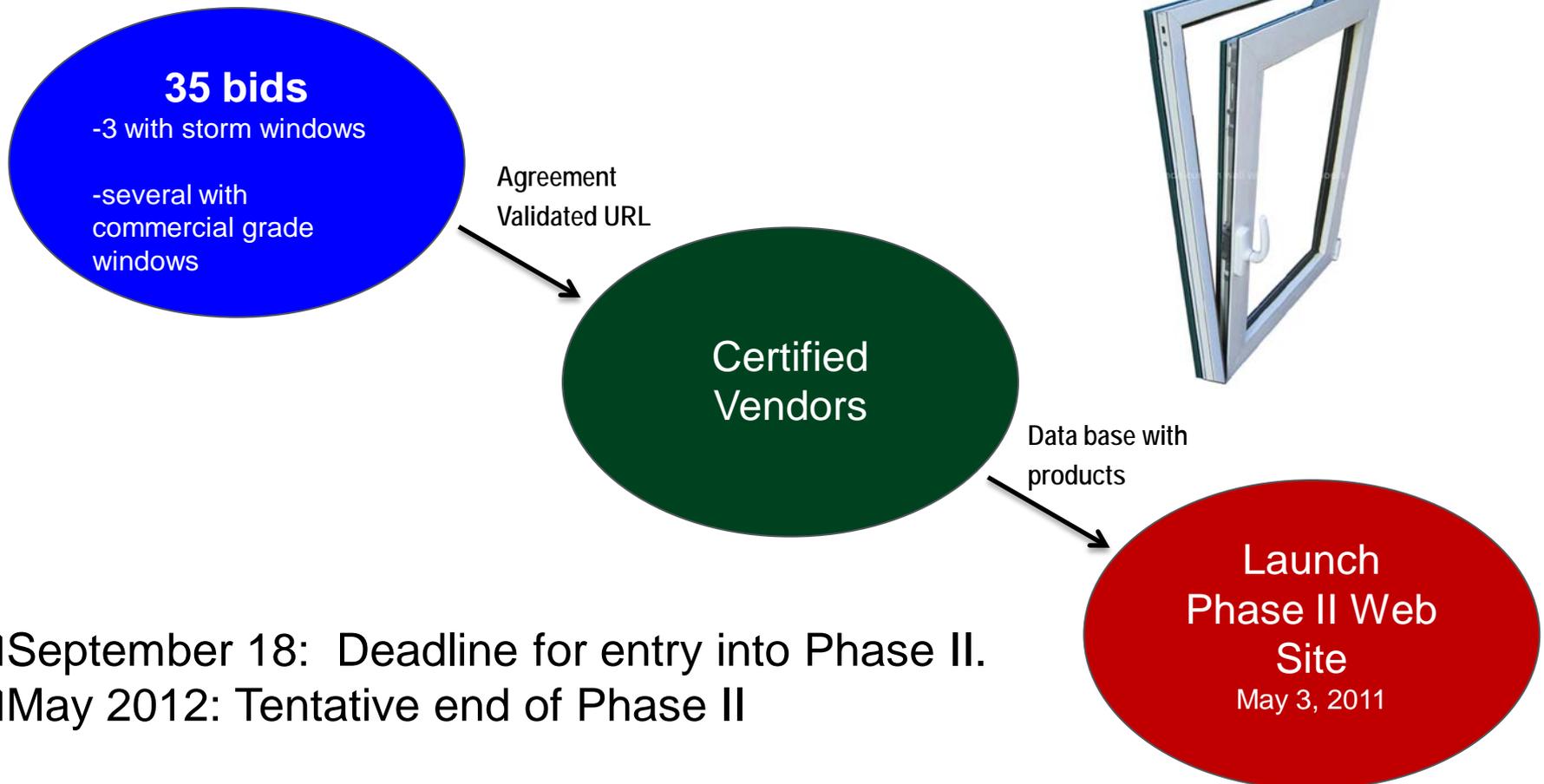
Phase I



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**



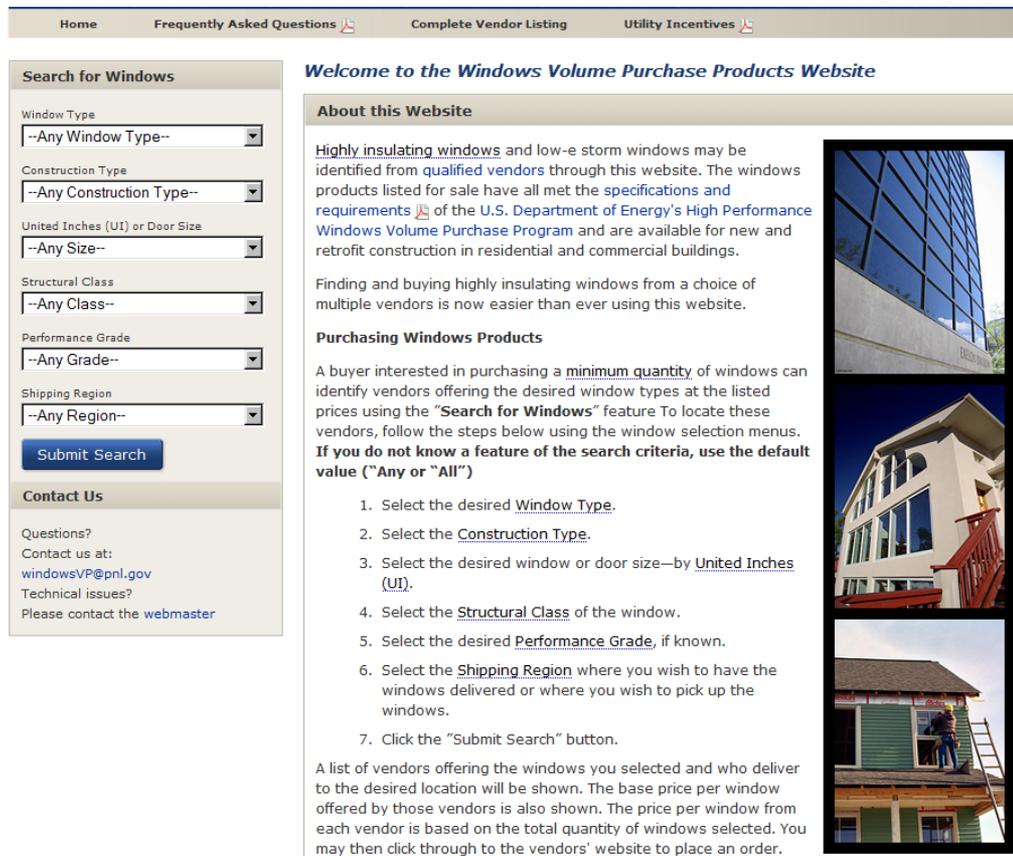
Low-e Storm Windows

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



www.windowsvolumepurchase.org

- Many homeowners are responding.
- Focus is now on contractors, builders, remodelers, institutions, and weatherization agencies.
- Sales through 08/11:
 - ~5,000 windows
 - ~\$1.6M 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. To the right, 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 explaining the program's goals, and a "Purchasing Windows Products" section with a 7-step guide for users. The guide includes steps for selecting window type, construction type, UI/door size, structural class, performance grade, shipping region, and clicking the search button. A final paragraph explains that a list of vendors and their prices will be shown, and users can click through to place an order. On the right side of the page, there are three images: a modern glass skyscraper, a multi-story residential building with a red staircase, and a construction 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.

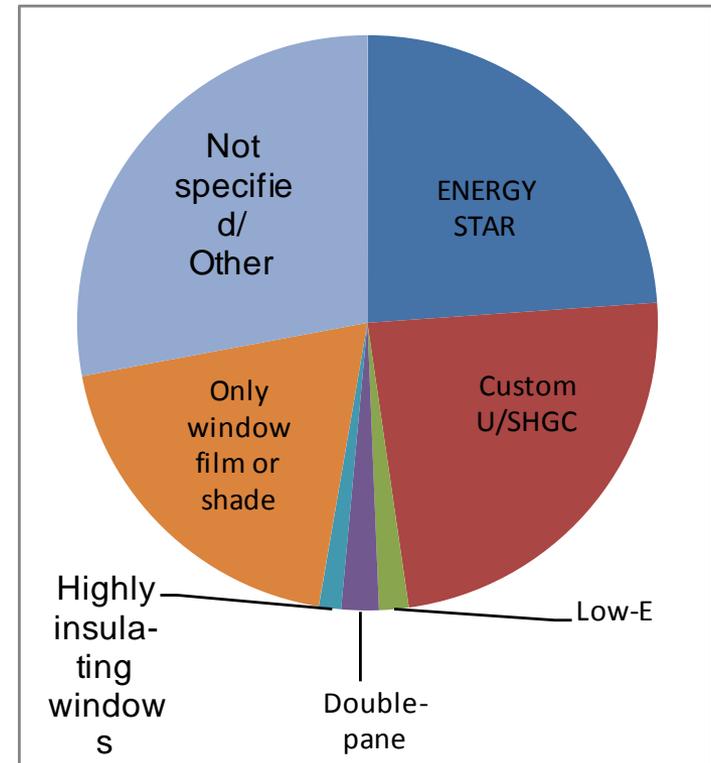
A list of vendors offering the windows you selected and who deliver to the desired location will be shown. The base price per window offered by those vendors is also shown. The price per window from each vendor is based on the total quantity of windows selected. You may then click through to the vendors'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

WVP Program Impacts and Achievements

**Walt Zalis, Energetics
Incorporated**

- In 15 months, the program sold **over 5,000 windows** and achieved **~\$1.6 million in sales**
- Over 40 Phase I participants
- Over 30 Round II participants

“We are glad to have been part of the R-5 Windows Volume Purchase program since its inception in 2010. The program has challenged B.F. Rich and our vendors to look at the development of new technologiesat an affordable cost to the consumer We have grown our R-5 program at B.F. Rich in both triple and double glazed windows....”

*--George Simmons
President and CEO, B.F. Rich Windows & Doors*

“The value of the DOE High Performance WVPP has been in setting the table for future sales during a down market. My belief is that manufacturers such as JELD-WEN have seen only small incremental sales increases attributable to the launch of the program. However, heightened awareness of high performance windows during a lean time when industry design and construction professionals are slow will serve to grow sales once the market picks up....”

*--Rob Worthington
Market Development Director, JELD-WEN*

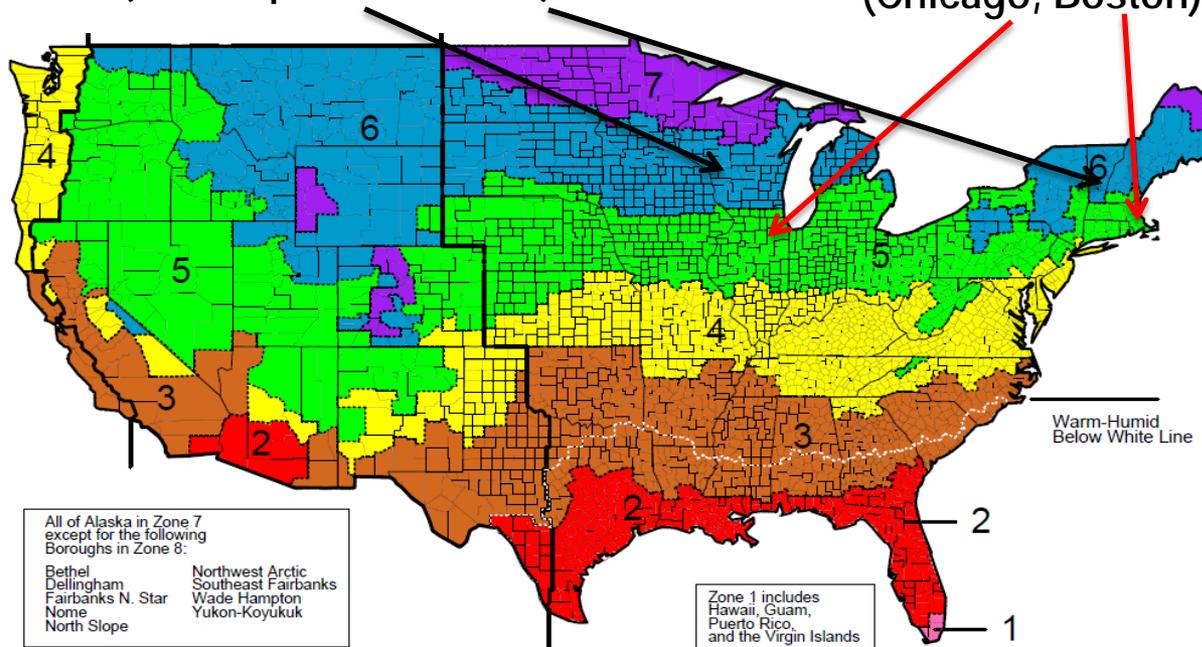
- WVP program has appeared in **85 articles** in top media and building industry publications **in less than 2.5 years**
 - **New York Times:** “DOE Aims to Make 'Low E' Windows a Must-Have for Home Construction,” June 2010
 - **Chicago Tribune:** “Government raising bar on windows,” January 2010
 - **Window and Door:** “Phase II Begins for DOE Volume Purchase Program,” May 2011
 - **Door and Window Manufacturer:** “Are you ready for Phase II?,” May 2011
- Window and Door magazine conducted a poll in September 2011 asking, **“Is Your Company Still Promoting R-5 Products”**
 - **Over 50% respond, “Yes, and it still works well for us”**
 - Only 5% respond, “We did, but we have stopped”
 - The author states “I know a lot of manufacturers liked the simplicity of DOE's R-5 rating. It was something they could hang their hat on in their marketing.”
- Obtained 23 letters of support from builders, weatherization agencies, non-profits and others

BSC developed recommendations for window performance in Northern climates that are closely aligned with WVP requirements

Based on Building America program experience – recommendations for homes with low energy needs that can be met by renewable energy sources

U-factor for Climate Zone 6
(Minneapolis, Vermont) = 0.18

U-factor for Climate Zone 5
(Chicago, Boston) = 0.24



WVP Window
= 0.22 U-factor

The Building Science Corporation Report: Building America Special Research Project: High R-Value Enclosures for High Performance Residential Buildings in All Climate Zones

< <http://www.buildingscience.com/documents/reports/rr-1005-building-america-high-r-value-high-performance-residential-buildings-all-climate-zones> >

The Energy Trust of Oregon Aligns with WVP

- The Energy Trust of Oregon already provided incentives for ENERGYSTAR windows and needed a higher performance tier
- Current high performance tier aligns with the WVP program requirements, benefiting from increased product availability for incentive recipients
- **Applicable incentive**
 - Electric- and gas-heated homes: **\$3.50** per square foot of windows installed with **U-Value 0.22 or less**
 - No longer needs to be installed with second energy-saving improvement, though homeowners are encouraged to make further improvements



- A 2010 study completed by nationally recognized expert on green home design, Ann V. Edminster, reviewed popular energy improvement options, including R-5 windows
- "If I have \$15,000 to spend on my home to reduce energy use as much as possible, what gives the best bang for the buck?"
 - In the single-pane (R-1) window replacement scenario, the high R-value replacement windows were the top choice performance-wise with 38.4% energy savings improvement.
 - Compared to a whole house energy improvement package (12.4%) and installation of a PV solar system (12.1%)
 - Study results clearly indicate that high R-value replacement windows are competitive with other retrofit alternatives in various situations

"R-5 and above windows represent a game-changing entry into the residential replacement window market and into the broader realm of energy efficiency retrofit options. While in the past, window replacement was not typically viewed as offering a good return on investment from an energy perspective, it should now be considered routinely for home energy retrofit projects, with comfort improvements the icing on the cake."

--Ann V. Edminster
M. Arch., LEED AP+ Homes

- 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

The screenshot displays the NEAT AUDIT software interface. The main window title is "NEAT AUDIT". The interface includes several sections:

- Audit Information:** Fields for Audit Name (Audit 126), Client ID (Exposed Floor 1), Client Name, and Alt. Client ID.
- Client Information:** Fields for Agency Name (PA WVP), Agency State (PA), and Auditor (GFD).
- Conditioned Spaces:** Fields for Conditioned Spaces (2) and Floor Area (sq ft) (1600).
- Comment:** A text box containing "W/V Insulation throughout. Open Joint Airt. See foundation description of exposed floor components."
- Economic Summary:** A box showing "Measures Recommended" (0), "Total Initial Cost (\$)" (\$4,401.52), and "Cumulative SIR" (1.32).
- AUDIT:** Fields for "by Audit Name" and "by Client ID".
- REPORT:** A dropdown menu for "Select Report" set to "Recommended Measures", with buttons for "Previous", "Next", and "Snapshot File".

Low-E Storm Windows

- Selected as qualified measure with standard investment ratio (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

- Coordinated 7 regional workshops across the country
 - Chicago, IL (September 2010)
 - Portland, OR (October 2010)
 - Philadelphia, PA (October 2010)
 - Columbus, OH (April 2011)
 - Clearfield, UT (May 2011)
 - Bozeman, MT (July 2011)
 - Golden, CO (October 2011)
- Facilitated 10 webinars with trade associations and non-profits
- Presented at 28 conferences and meetings



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