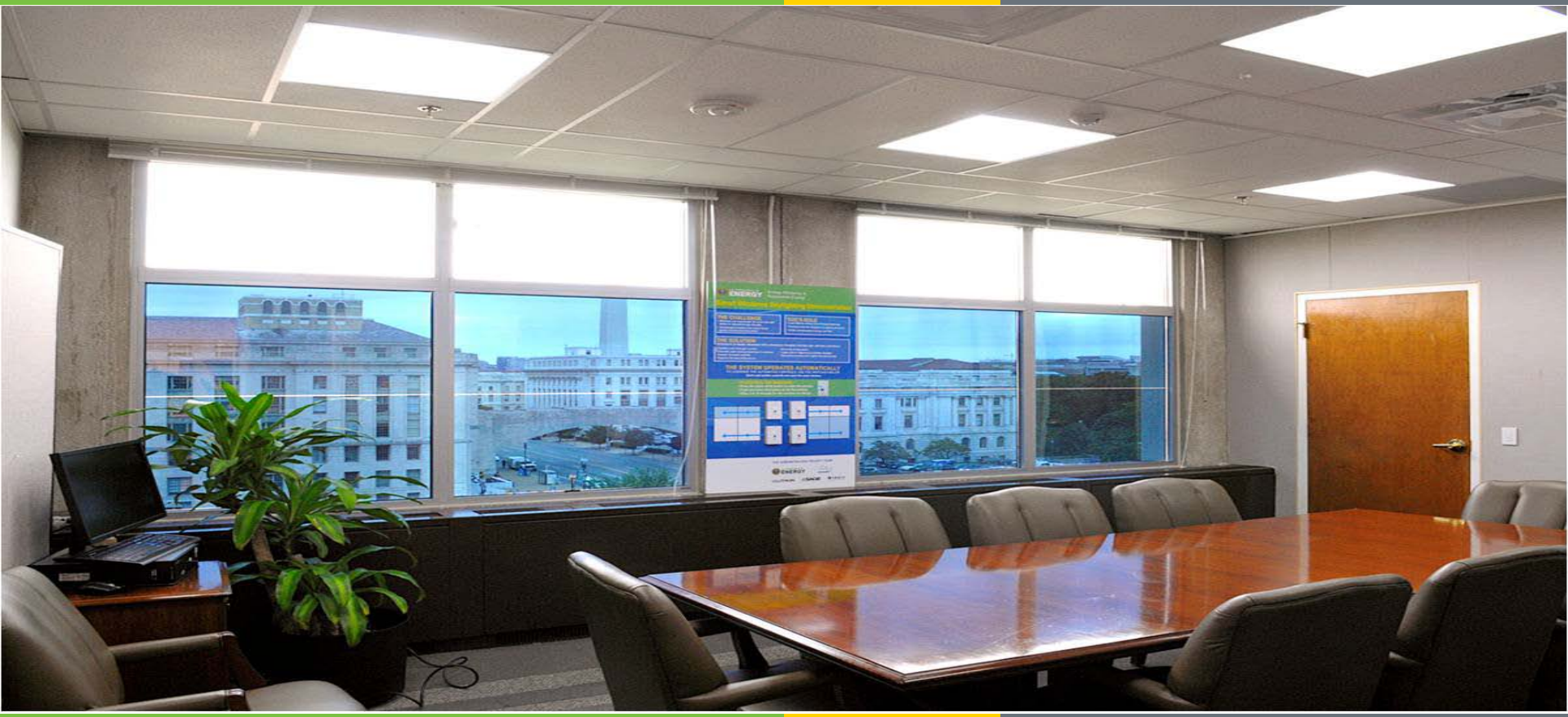
Building Technologies Program

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



Window and Envelope Solutions for Today and Tomorrow

Commercial Building Energy Alliance
October 12, 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

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

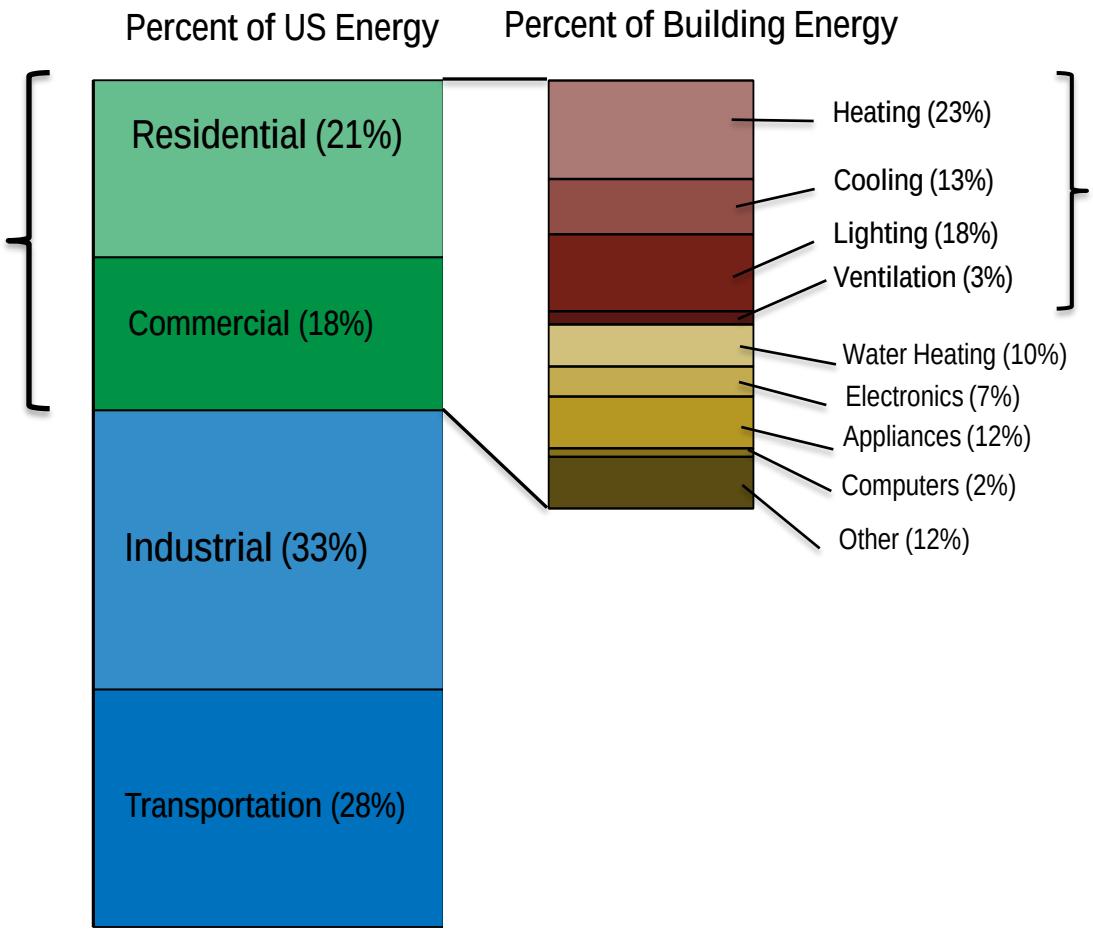
DOE and Windows

How the WVP program fits into the big picture

Terry Mapes
Pacific Northwest National Laboratory

Why worry about windows?

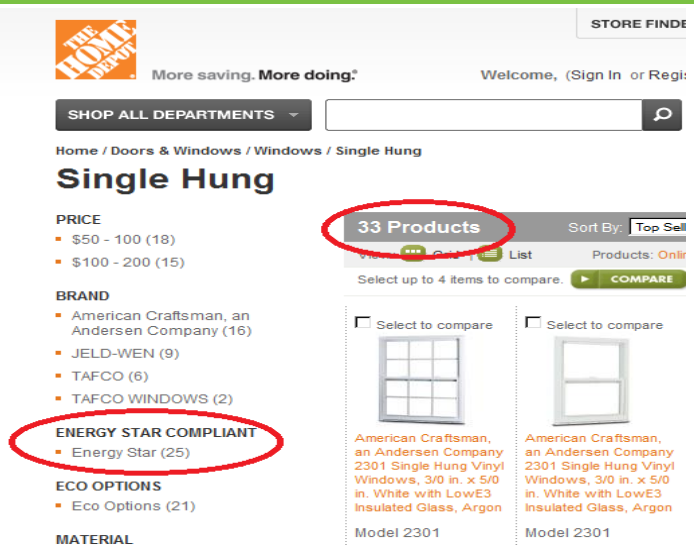
Buildings are responsible for about 40% of US primary energy consumption

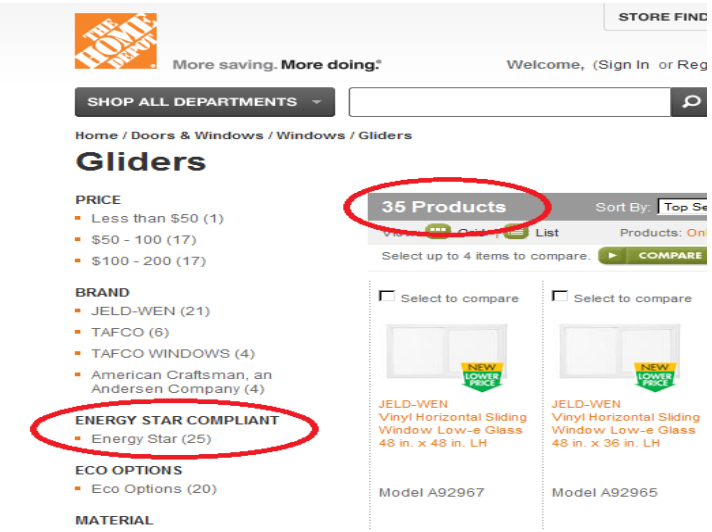


58% of the energy used in a building is impacted by windows. Almost 14% of the total energy in the US.

Current Residential Windows Market

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



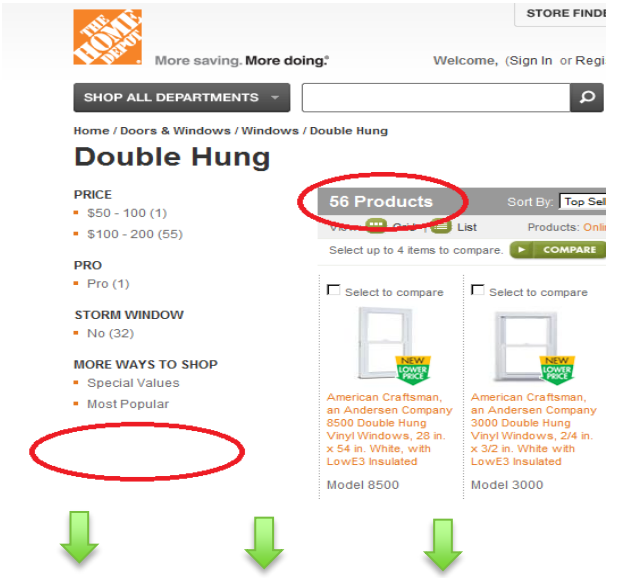


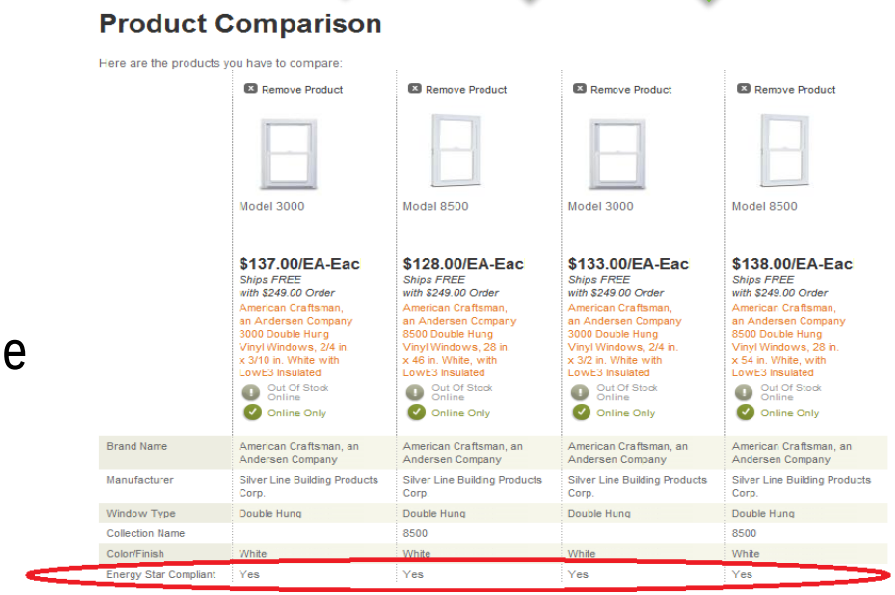
Home Depot

Three largest window categories

Over 85% Energy Star compliant

R3 is now becoming the BASELINE





Total Building Envelope and Window R&D Budget

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

	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 ARRA 10.5M Windows 25M 5.5M Envelope
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

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

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

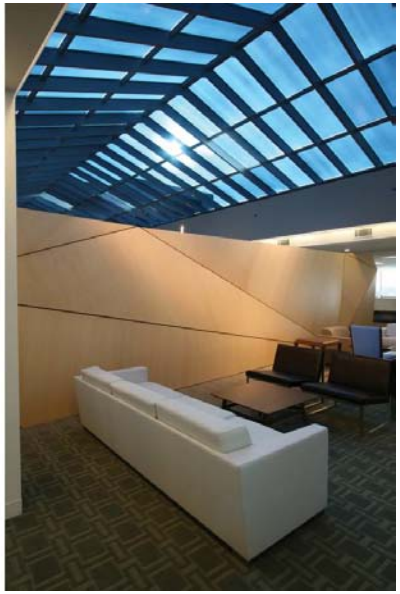
Support utility programs for advanced windows

ENERGY STAR spec revision

ENERGY STAR Spec Development

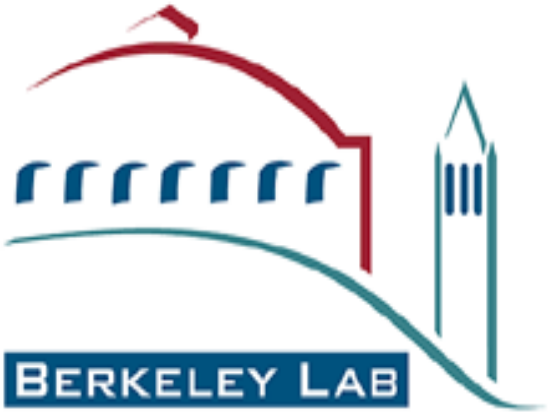
DOE Goals for Windows Programs

- 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



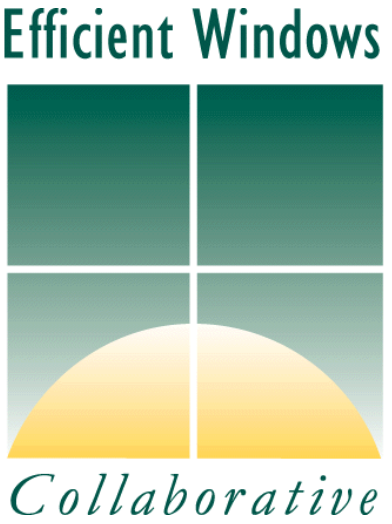
Prototype – Concept Window
Highly Insulating and Dynamic
SHGC 0.04 – 0.34

DOE Assists with Technical Support Activities



http://windows.lbl.gov/software

www.nfrc.org



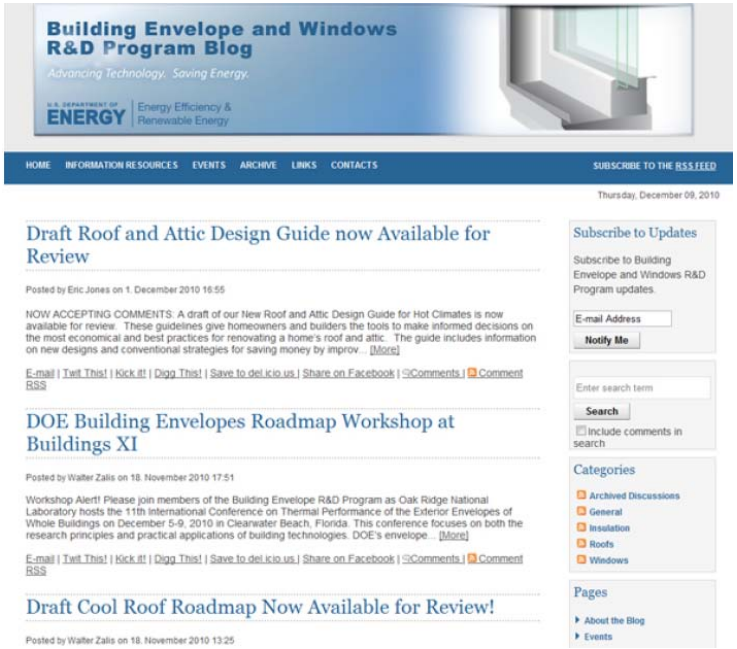
www.efficientwindows.org

- 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

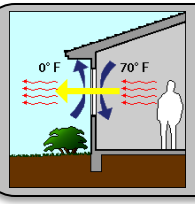
Low-E Storm Windows

Nils Petermann

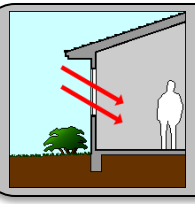
Alliance to Save Energy

Window Energy Ratings

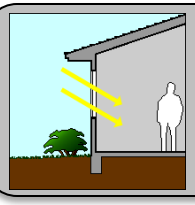
Window energy performance metrics



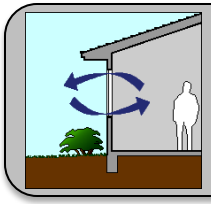
U-factor
Measures how insulating a window is
Lower = less heat loss



Solar Heat Gain Coefficient (SHGC)
Fraction of solar energy entering window
Higher = more solar energy



Visible Transmittance (VT)
Fraction of visible light entering through window
Higher = more daylight

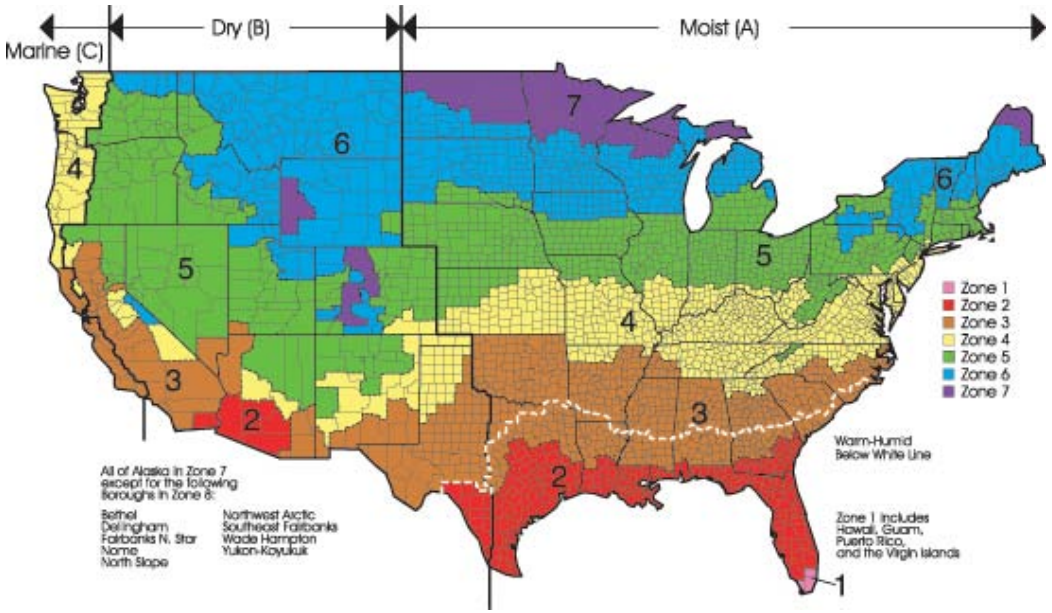


Air Leakage (AL)
Volume of air passing through window
Lower = less infiltration

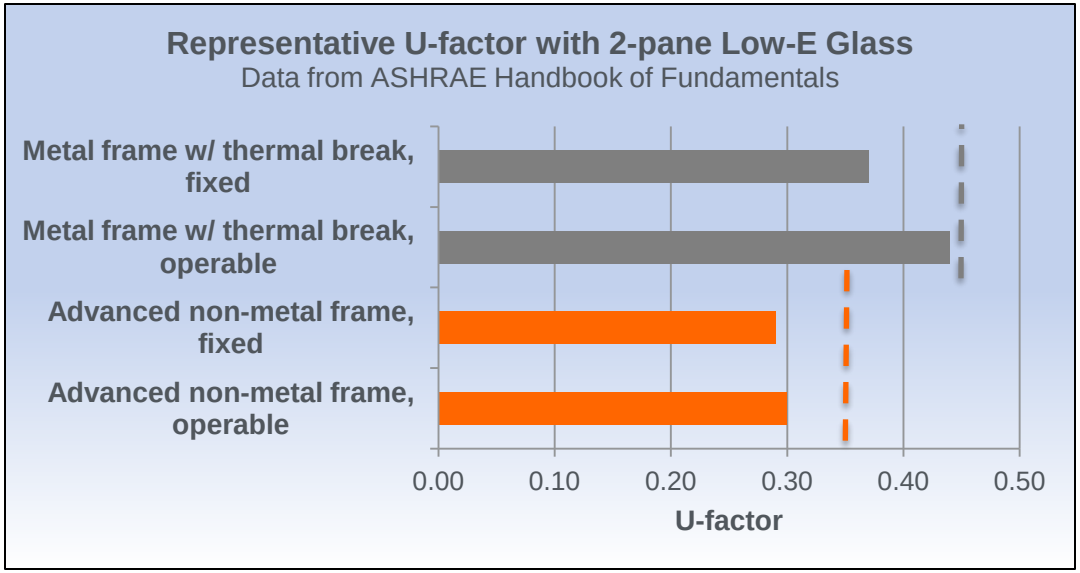
Energy codes require whole-window ratings based on NFRC standards

Energy Code Requirements: 2009 IECC / ASHRAE 90.1-2007

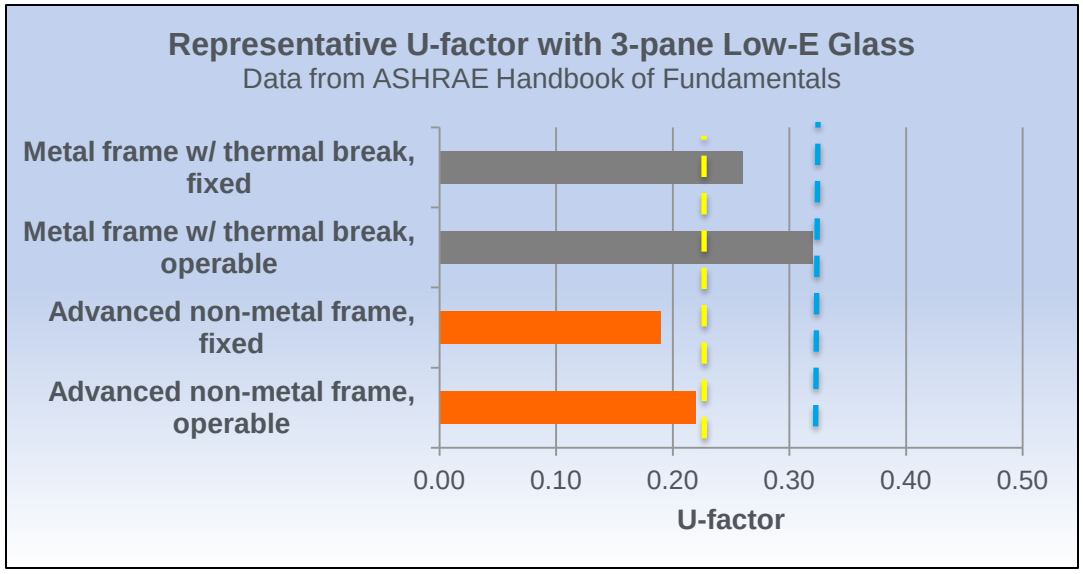
Climate Zone	2009 IECC / ASHRAE 90.1-2007		
	U-factor		SHGC
	Non-Metal Frame	Metal Frame	All Windows
8	**0.35**	**0.45**	**0.45**
7	**0.35**	**0.45**	**0.45**
6	**0.35**	**0.55**	**0.40**
5	**0.35**	**0.55**	**0.40**
4	**0.40**	**0.55**	**0.40**
3	0.65	0.65	0.25
2	0.75	0.75	0.25
1	1.20	1.20	0.25



Window U-factors in Perspective

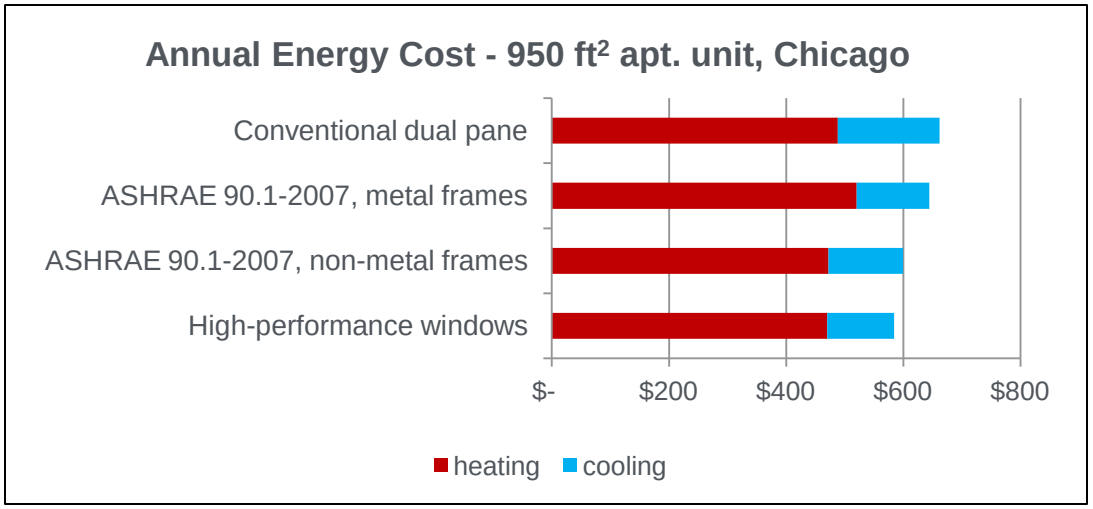


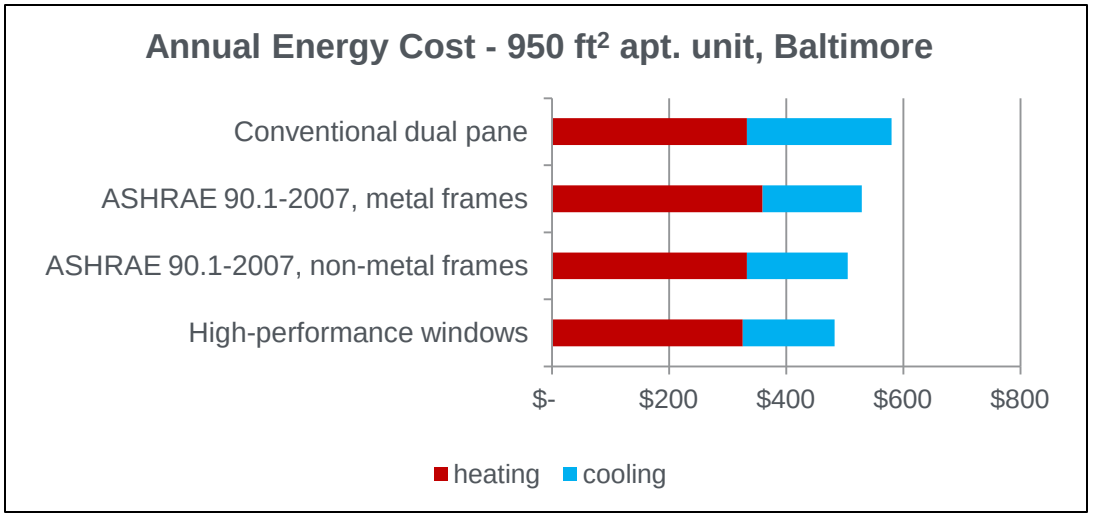
90.1-2007 Window U-factor Requirements		
Climate Zone	**Metal**	**Non-Metal**
Climate Zones 7-8	**0.45**	**0.35**
Climate Zones 5-6	0.55	**0.35**
Climate Zone 4	0.55	0.4



DOE High-Performance Window U-factor Specs		
Structural Performance	**Operable**	**Fixed**
R or LC performance class	**0.22**	0.2
CW performance class	0.27	0.24
AW performance class	**0.32**	0.27

Energy Cost Example
Simulated 950 ft² apartment unit





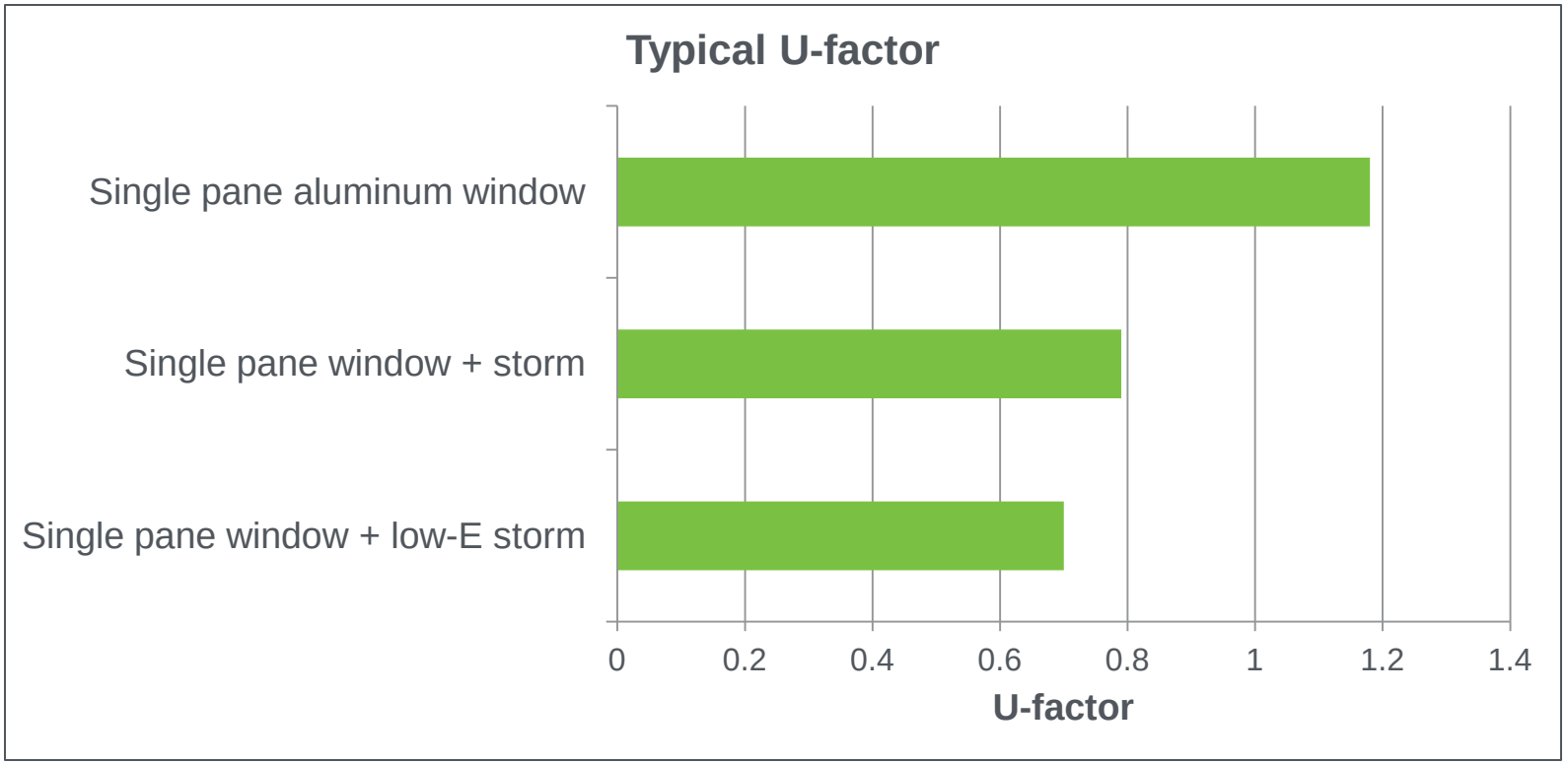
Simulated with EnergyPlus

35% window-to-wall ratio

Assumed energy prices:

- $1.20/therm natural gas
- $0.12/kWh electricity

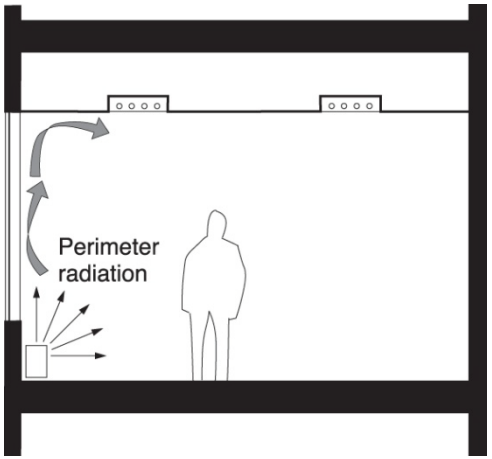
Low-E Storm Windows



Highly Insulating Windows and Heating System Design

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

- Cold window surfaces are a main cause of discomfort
- Conventional solution: perimeter heating near windows
- Perimeter heat may not be necessary with highly insulating windows

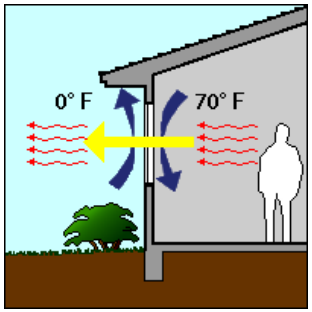


Case in Point: Cambria Office Facility, Ebensburg, PA

- Triple-pane windows, U-factor 0.24-0.26
- Incremental cost of windows compared to dual pane: $15,000
- No need for perimeter heating = $25,000 up-front cost savings
- At 20°F outside, interior window surface remains at 62°F

Source: Carmody et al. 2004. *Window Systems for High-Performance Buildings*

U-factor and Winter Comfort

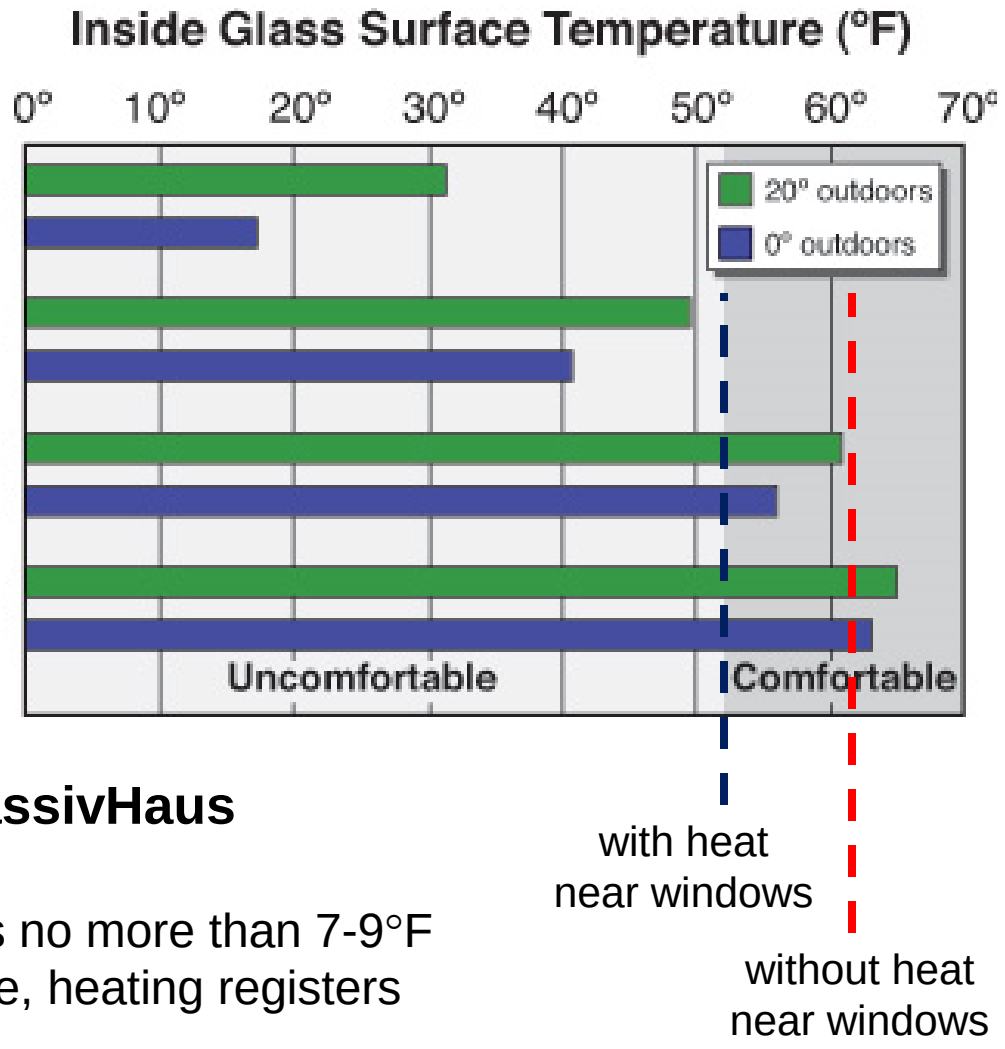


Single pane (U ~0.85)

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 7-9°F below average room temperature, heating registers near windows are not needed.

Solar Heat Gain

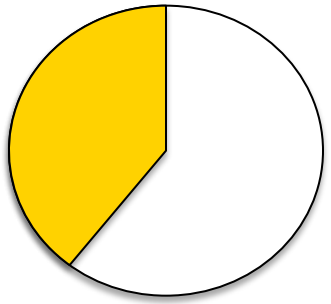
Optimum solar heat gain coefficient (SHGC) depends on factors such as:

- Climate
- Orientation
- Available shading
- Internal heat loads

In most heating dominated climates (NYC, Boston, Chicago, Seattle, etc.) ASHRAE 90.1-2007 requires SHGC ≤ 0.40

SHGC of commercial windows in Volume Purchase Program ranges between 0.15 and 0.37

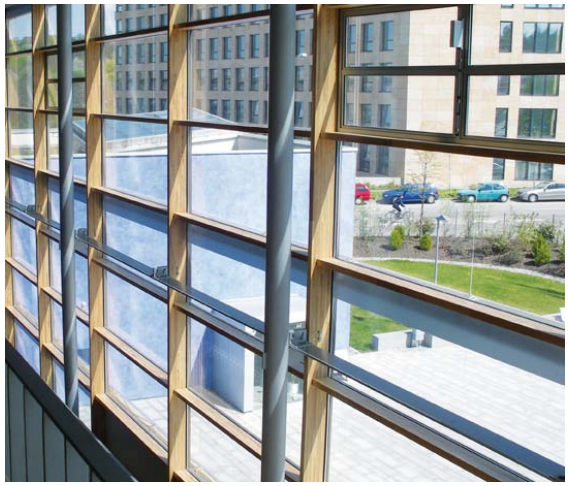
Average SHGC: 0.24



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 II Status

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

35 bids
-3 with storm windows

-several with commercial grade windows

Agreement
Validated URL

Certified Vendors

Data base with products

Launch Phase II Web Site
May 3, 2011

- ❑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/ft^2
- Condensation Resistance: ≥50
- Certifications: NFRC/NAFS
- Warranty (yr): 20 glass/10 non-glass
- NAFS 05: Performance Grade R25

Low-e Storm Windows

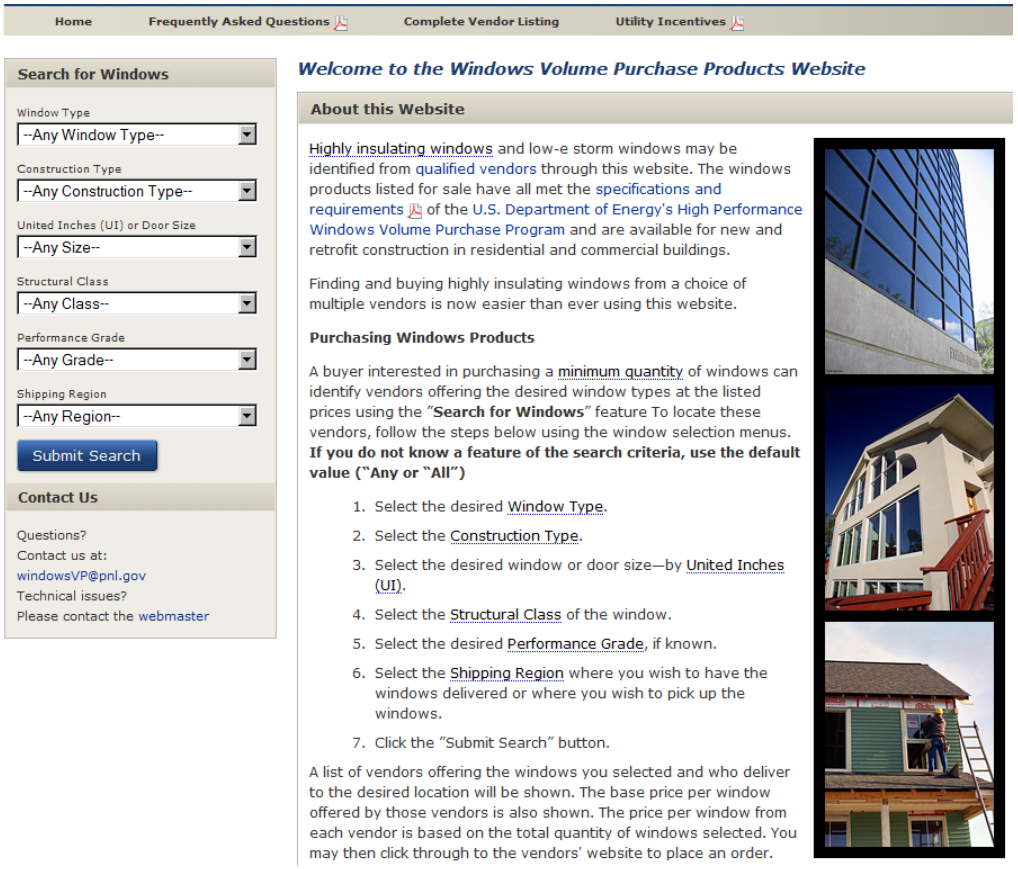
- Emissivity: <0.22
- Certifications: ANSI/AAMA 1002.10-93
- Registry: IGDB (LBNL database)
- Warranty (yr): 10 glass/non-glass

Windows Products Website

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

www.windowsvolumepurchase.org

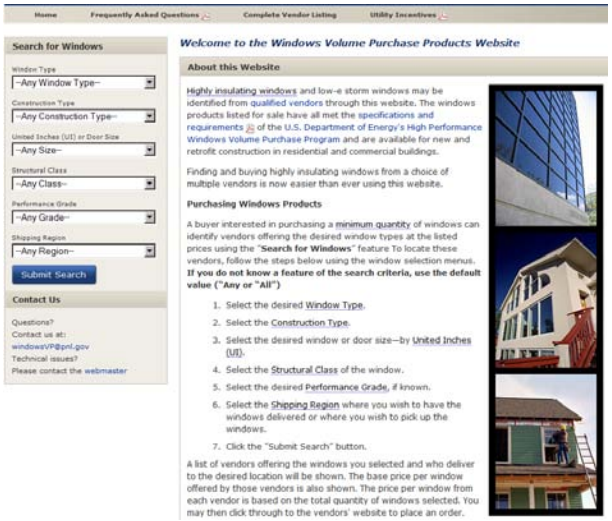
- Many homeowners are responding.
- Focus is now on contractors, builders, remodelers, institutions, and weatherization agencies.
- Sales through 08/11:
  - ~5,000 windows
  - ~$1.6M in sales
- Phase II products: May 3, 2011

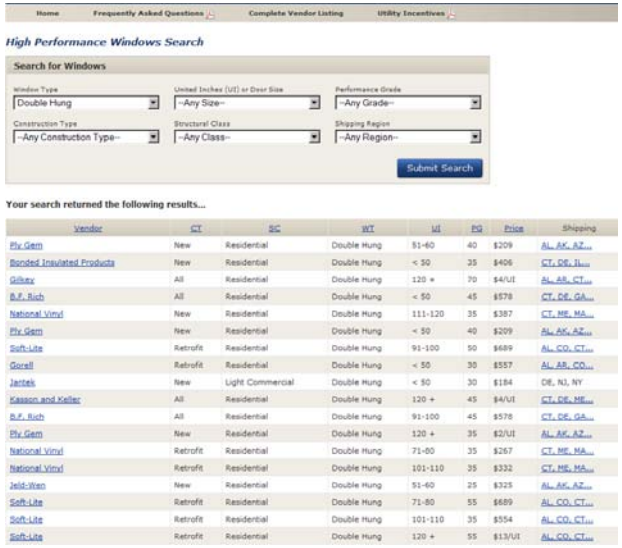


Phase II

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

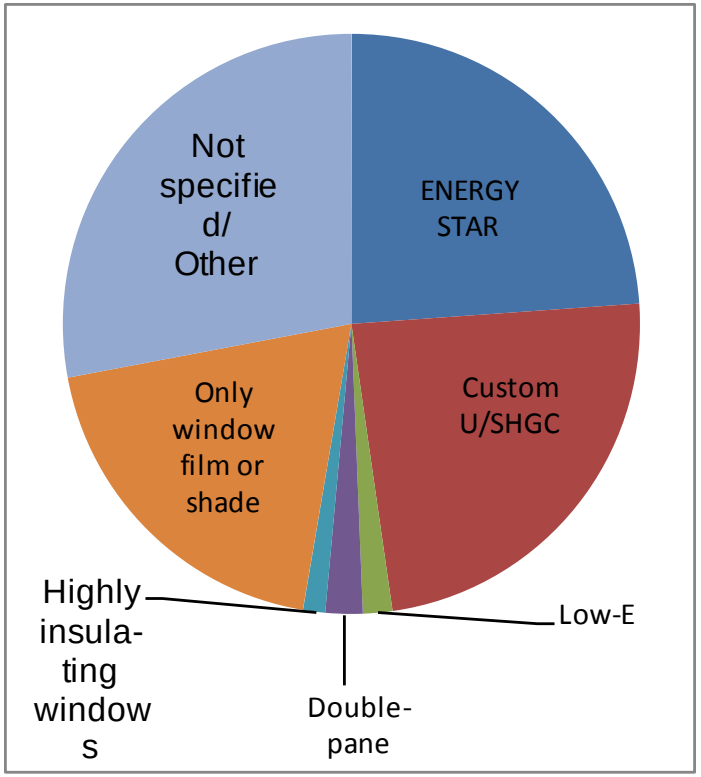




Current Windows Incentive Programs

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

- 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

Contacts

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

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

Myra Sinnott
Energetics Incorporated
msinnott@energetics.com
202-406-4123

NFRC Energy Ratings

Commercial Building
Energy Alliance
October 12, 2011

Ray McGowan-Senior Program Manager

NFRC—Introduction & Overview

- Formed by industry in 1989
- To provide standardized *fenestration energy performance* ratings
- Educational non-profit public/private organization, not a trade association, 501 C3
  - 17 on staff in five states, HQ near Washington DC
  - 800 participants (manufacturers labeling product)
  - 250 members (vote at meetings, develop standards)
  - Members may be:
    - Fenestration and related building industry
    - State energy offices
    - Design professionals
    - Utilities, consumer organizations
    - Anyone with a fenestration interest

NFRC is Widely Referenced

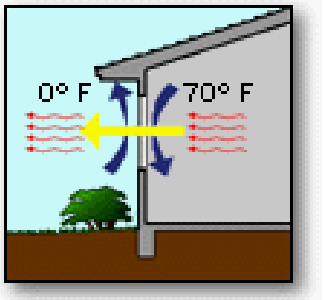
- **IECC**
- **ASHRAE 90.1**
- ***ENERGY STAR©***
- **USGBC's LEED program**

NFRC Ratings

- Heat loss rating *(U-factor)*
- Solar Heat Gain rating *(SHGC)*
- Visible Transmittance rating *(VT)*
- Air Leakage rating
- Condensation Resistance rating *(CR)*

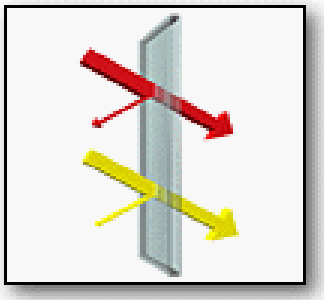
National Fenestration Rating Council®

NFRC Ratings



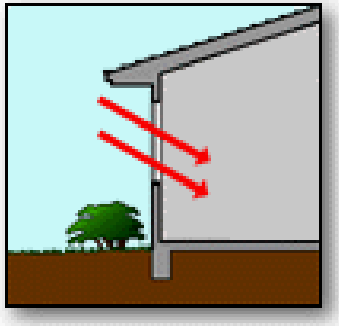
U-factor (thermal transmission)

NFRC 100



VT (Visible Transmittance)

NFRC 200



SHGC (Solar Heat Gain)
NFRC 200

National Fenestration Rating Council®

NFRC Rating Determination

- Computer simulation is the basis of all ratings
- Simulation performed at standardized sizes & environmental conditions
- Simulation generates a **whole-product rating**
- Simulated U-factors validated by physical testing
  - 4000 tests/year

National Fenestration Rating Council®

NFRC & Code Compliance

- **Why the increased interest in compliance?**
  - Energy price increases
  - Enhanced code enforcement by states
- **State Energy Code requirements**
  - IECC and ASHRAE 90.1 requires NFRC 100/200
  - No alternative

National Fenestration Rating Council®

NFRC 100/200 Satisfied by

- **Using WINDOW/THERM simulations plus NFRC certification for residential products**
  - 95% manufacturer participation
  - Required by ENERGY STAR
- **CMAST simulation for commercial products**
  - Almost no participation, about 150 certificates exist to date!!!
  - Reason: lack of enforcement and understanding

National Fenestration Rating Council®

Two ways for fenestration to comply with ASHRAE 90.1 or IECC:

- **Default**
- **NFRC Ratings**
  - NFRC 100 governs U-factor
  - NFRC 200 governs SHGC and VT
  - Whole product only
    - COG not allowed

National Fenestration Rating Council®

NFRC In IECC 2009

Refer to Chapter 3

303.1.3 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table 303.1.3(1) or 303.1.3(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 303.1.3(3).

National Fenestration Rating Council®

NFRC in ASHRAE 90.1-07

5.8.2.4 U-factor. U-factors shall be determined in accordance with NFRC 100. U-factors for skylights shall be determined for a slope of 20 degrees above the horizontal.

5.8.2.5 Solar Heat Gain Coefficient. *SHGC* for the overall *fenestration area* shall be determined in accordance with NFRC 200.

National Fenestration Rating Council®

NFRC & Code Compliance

a. Determine fenestration used on project:

Excellent reference is the NFRC 'Bid Report'

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – NFRC STANDARD SIZE

NOTE: This is NOT an NFRC Label Certificate. This document can NOT be used in place of NFRC Label Certificate and can be used only for Bid and Design Purposes

PRODUCT LISTING:

					Performance at NFRC Standard Size		
ID	Name	Framing Ref	Glazing Ref	Spacer Ref	U	SHGC	VT
					Btu/h·ft²·F	-	-
P-EFC-4207	SFTestBB	FA-EFC-6689	GA-SOU-3331	SA-PPG-2524	0.30	0.20	0.29

FRAME, GLAZING and SPACER ASSEMBLIES:

GLAZING LISTING:

Glazing Ref	Suplier ID	Description
GA-SOU-3331	Southwall Technologies	

SPACER LISTING:

Spacer Ref	Suplier ID	Description
SA-PPG-2524	PPG Industries	

FRAMING LISTING:

Framing Ref	Suplier ID	Description
FA-EFC-6689	EFCO Corporation	

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – ACTUAL PRODUCT SIZE

PRODUCT LISTING:

					Fenestration Performance at Actual Size*				
ID	Qty	Total Area	Name	EnergyPlus Report File	Width	Height	U	SHGC	VT
		in²			in.	in.	Btu/h·ft²·F	-	-
P-EFC-4207	125	2159999.60	SFTestBB		120.00	144.00	0.24	0.21	0.30

* *Individual product performance at actual size is listed in the above table and has been determined in accordance with NFRC technical procedures, however the actual size performance calculations above are for information purposes and use in area-weighted average calculations and energy simulation programs.*

National Fenestration Rating Council®

NFRC & Code Compliance

NFRC 'Bid Report'

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES -- NFRC STANDARD SIZE

NOTE: This is NOT an NFRC Label Certificate. This document can NOT be used in place of NFRC Label Certificate and can be used only for Bid and Design Purposes

PRODUCT LISTING:

ID	Name	Framing Ref	Glazing Ref	Spacer Ref	U	SHGC	VT
					Btu/h-ft^2-F	-	-
P-POL-1234	2011 Polaris Curtain Wall	FA-PO CW-001	GA-SOU-3331	SA-PPG-2524	0.40	0.29	0.40
P-POL-1234	2011 Polaris Store Front	FA-PO SF-001	GA-SOU-3331	SA-PPG-2524	0.45	0.30	0.39
P-POL-1234	2011 Polaris Casement	FA-PO CS-001	GA-SOU-3331	SA-PPG-2524	0.44	0.30	0.38

National Fenestration Rating Council®

US Green Building Council's LEED Program

- **Energy and Atmosphere section requires ASHRAE 90.1-2007 as mandatory minimum**
  - NFRC 100 and 200 required by ASHRAE 90.1
  - LEED scores improve by beating this minimum
- **All LEED projects require NFRC ratings**
  - Poorly enforced
  - Recent activity indicating improved performance
- **Improved daylighting improve LEED score also**

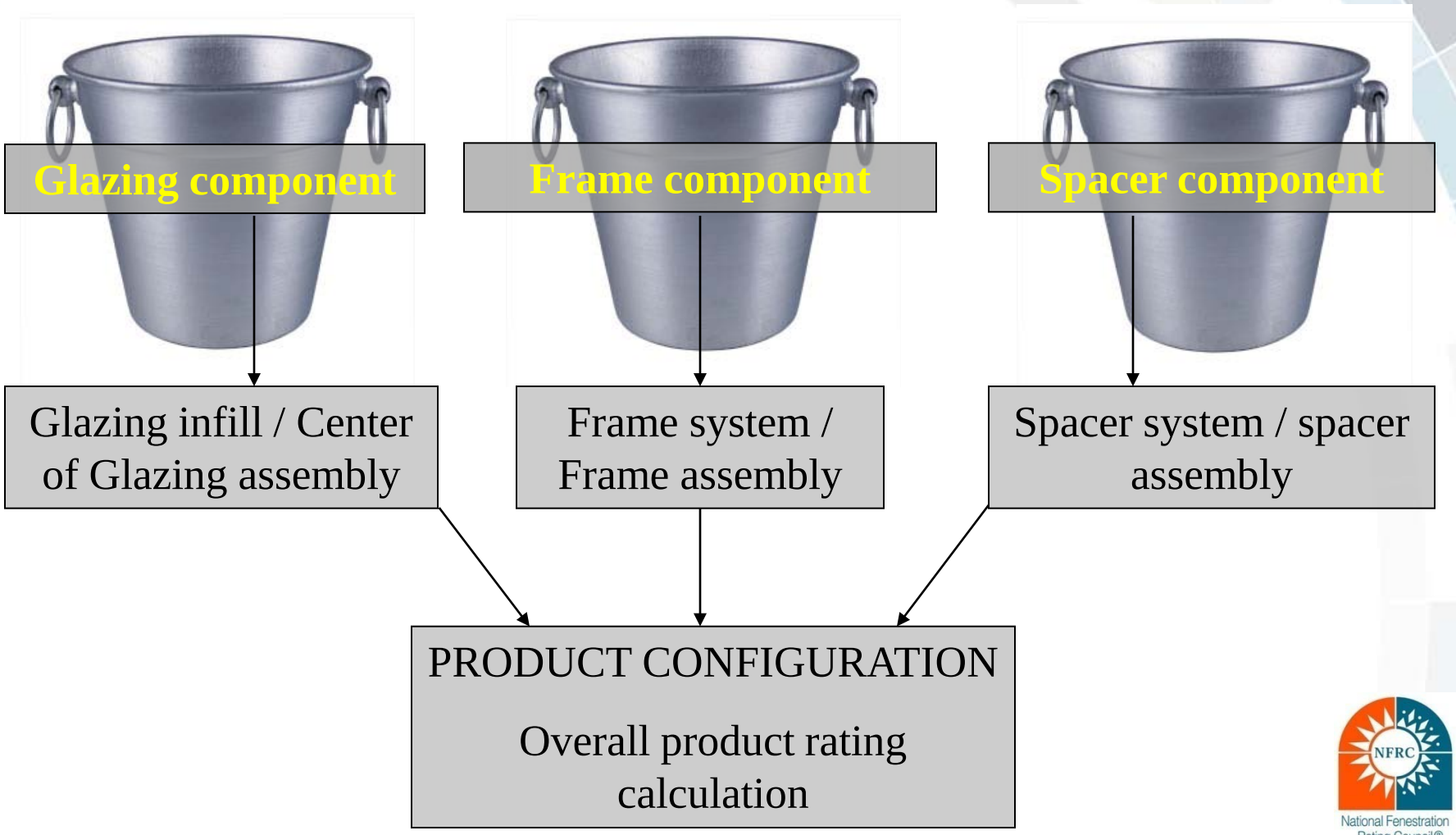
Non-Residential Certification

D. Overview of the *Component Modeling Approach* ('CMA') Program

Non-Res. Certification: CMA

New concept: *build* virtual products & projects using predefined and certified components from online CMA database to issue project-specific label certificates

Non-Res. Certification: CMA



Non-Res. Certification: CMA

- The CMA process ~ **Required Parties:**
  - The manufacturers of frames, spacers, glass
  - The specifying authority (SA)
  - The accredited simulation laboratory (ASL)
  - The accredited testing laboratory (ATL)
  - The 'Approved Calculation Entity' (ACE)
  - The 3rd party validator ('IA')
  - NFRC

Non-Res. Certification: CMA

- **The CMA process: The SA**
  - **The role of SA (Specifying Authority) can be taken on by various stakeholders including *(but not limited to)*:**
    - **The architect**
    - **The GC (general contractor)**
    - **The glazing subcontractor**
    - **The manufacturer of the fenestration system**
  - **The SA executes a project-specific license agreement with NFRC, and pays for the label certificate based on fenestration square footage *(see fee schedule, on website)***
  - **The SA 'owns' the CMA Label Certificate**

Non-Res. Certification: CMA

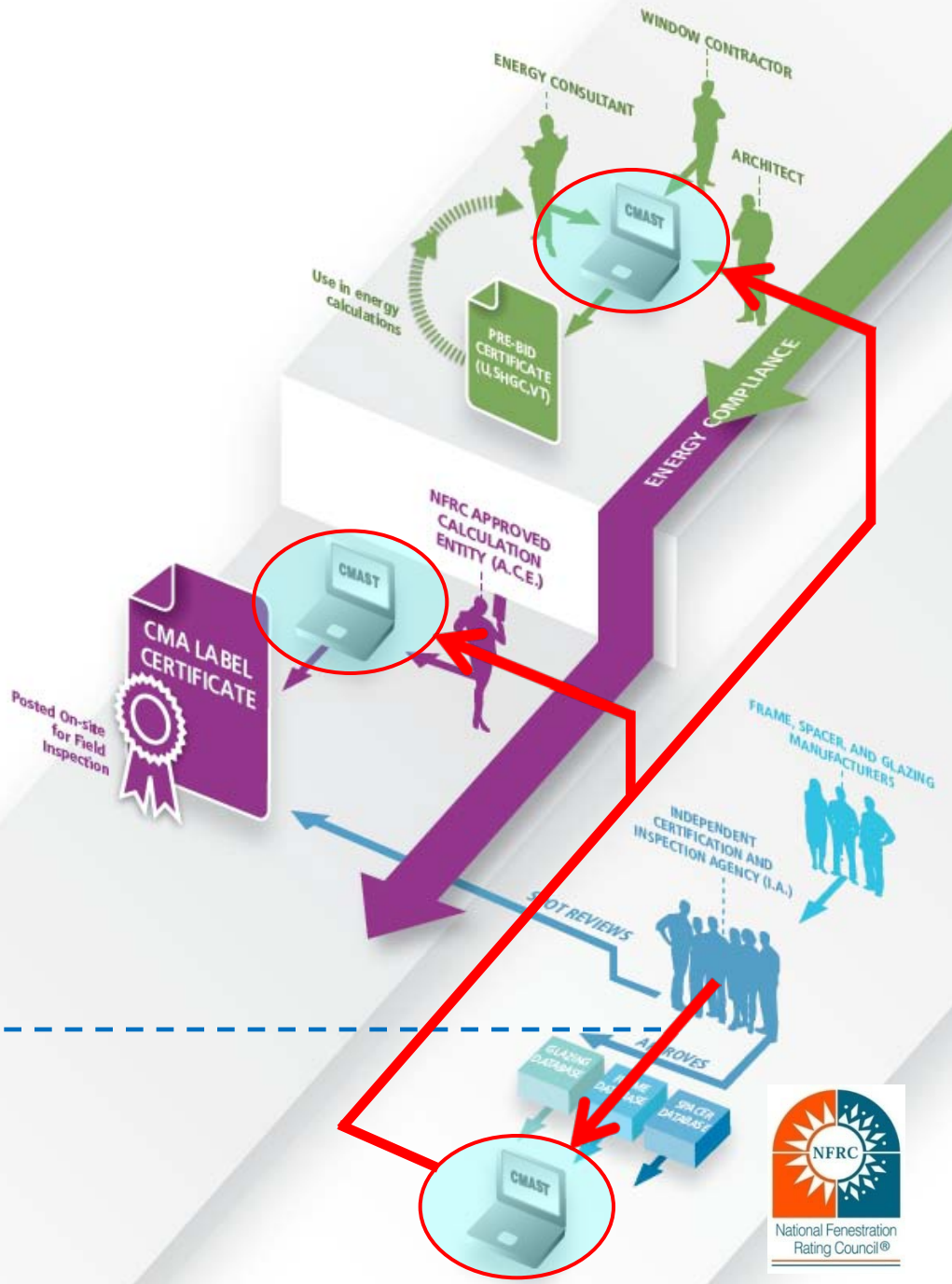
- **The CMA process: The ACE**
  - The ACE (Approved Calculation Entity) is a new "entity" within NFRC
  - The ACE is trained by NFRC to ensure quality
  - The **ACE must be employed by an 'ACE Organization'**; either **Manufacturer ACE** Org. or **Independent ACE** Org.
  - The ACE is the 'assembler' of CMA—approved components within CMAST
  - **ACE Organizations are the only party who can generate a label certificate for a project**

Non-Res. Certification: CMA

- **The CMA process: The IA**
  - The IA (Independent Certification and Inspection Agency) is an *existing* entity within the NFRC structure
  - Trained by NFRC on testing procedures of components
  - Reviews simulation lab and test lab reports
  - Reviews calculation reports prepared by ACE
  - Conducts random 'paper trail' audits of CMA Label Certificates

CMA Process

- CMAST DEVELOPMENT
  - The IA reviews and approves all components before they are available for use in CMA
  - Once uploaded into the online CMAST database, components are available to ***all users***



HESCHONG MAHONE GROUP

National Fenestration Rating Council®

Non-Res. Certification: CMAST

- CMA software tool (“CMAST”) can:
  - Maintain libraries of component data
  - Define projects
  - Assemble components, and
  - Calculate whole product ratings

Product

Product Information

Server ID: ? Client ID: 9

Product Name: HED

Manufacturer: Frames Inc

Description:

Notes:

Frame Assembly: FA-ACE-A

Product Type: Glazed Wall/Sloped Glazing

Width: 78.74 in. Height: 78.74 in.

Status: Design

Component Selection for Individual Product

Framing

Frame Member:

Insulated Glazing Unit

Center Of Glazing: Clr-6 Krypton85 LoE270-6

Spacer Edge Seal Assembly: TPS 12.7 mm

Dividers:

Visibility

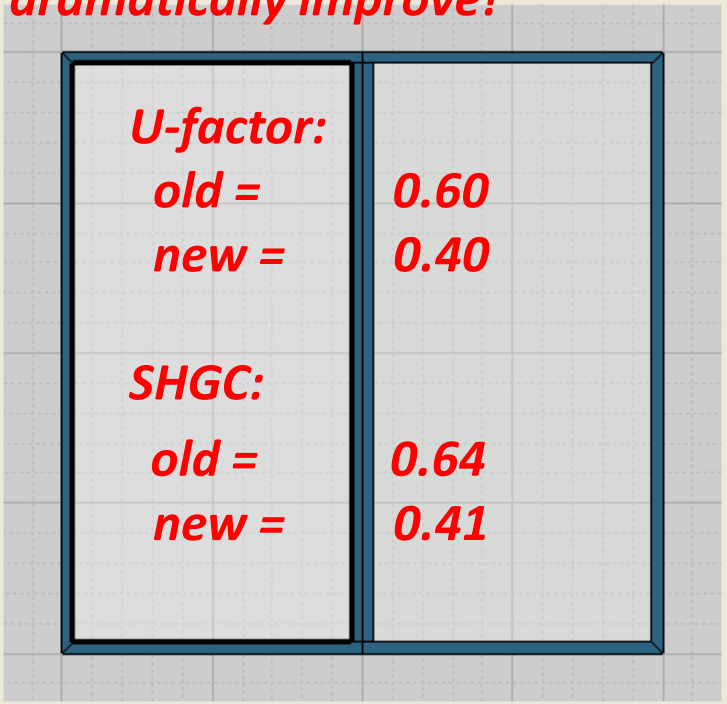
Myself Only

Additional Persons & Companies

NFRC Size:	78.74 X 78.74 in.	Actual Size:	78.74 X 78.74 in.
U factor:	0.401	0.401	Btu/h·ft²·F
SHGC:	0.407	0.407	
VT:	0.608	0.608	

Unit U-factor & SHGC dramatically improve!

Configuration

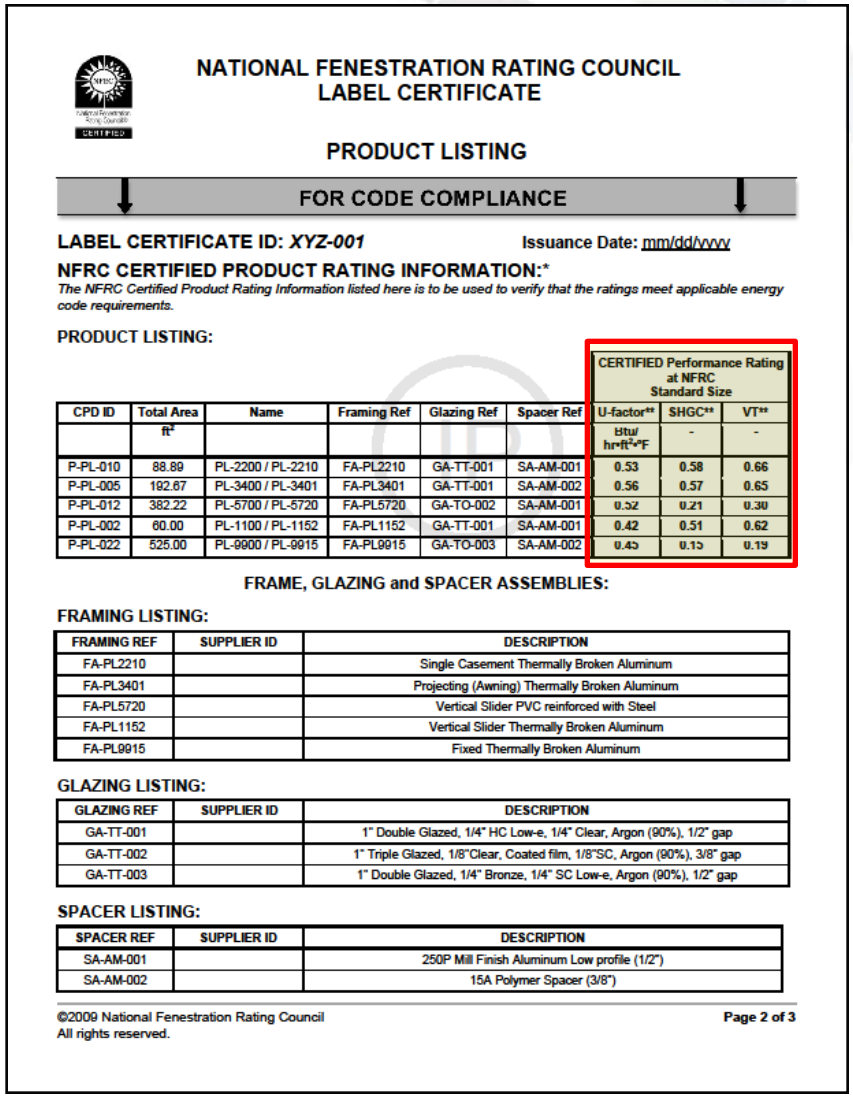


Edit Dims

History Calculate EnergyPlus Report OK

National Fenestration Rating Council®

NFRC CMA Label Certificate *(page 2):*



NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: ***XYZ-001*** **Issuance Date:** mm/dd/yyyy

NFRC CERTIFIED PRODUCT RATING INFORMATION:*

The NFRC Certified Product Rating Information listed here is to be used to verify that the ratings meet applicable energy code requirements.

PRODUCT LISTING:

CPD ID	Total Area	Name	Framing Ref	Glazing Ref	Spacer Ref	CERTIFIED Performance Rating at NFRC Standard Size		
	ft^2					U-factor** Btu/ hr-ft^2-°F	SHGC** -	VT** -
P-PL-010	88.89	PL-2200 / PL-2210	FA-PL2210	GA-TT-001	SA-AM-001	0.53	0.58	0.66
P-PL-005	192.67	PL-3400 / PL-3401	FA-PL3401	GA-TT-001	SA-AM-002	0.56	0.57	0.65
P-PL-012	382.22	PL-5700 / PL-5720	FA-PL5720	GA-TO-002	SA-AM-001	0.52	0.21	0.30
P-PL-002	60.00	PL-1100 / PL-1152	FA-PL1152	GA-TT-001	SA-AM-001	0.42	0.51	0.62
P-PL-022	525.00	PL-9900 / PL-9915	FA-PL9915	GA-TO-003	SA-AM-002	0.45	0.15	0.19

FRAME, GLAZING and SPACER ASSEMBLIES:

FRAMING LISTING:

FRAMING REF	SUPPLIER ID	DESCRIPTION
FA-PL2210		Single Casement Thermally Broken Aluminum
FA-PL3401		Projecting (Awning) Thermally Broken Aluminum
FA-PL5720		Vertical Slider PVC reinforced with Steel
FA-PL1152		Vertical Slider Thermally Broken Aluminum
FA-PL9915		Fixed Thermally Broken Aluminum

GLAZING LISTING:

GLAZING REF	SUPPLIER ID	DESCRIPTION
GA-TT-001		1" Double Glazed, 1/4" HC Low-e, 1/4" Clear, Argon (90%), 1/2" gap
GA-TT-002		1" Triple Glazed, 1/8"Clear, Coated film, 1/8"SC, Argon (90%), 3/8" gap
GA-TT-003		1" Double Glazed, 1/4" Bronze, 1/4" SC Low-e, Argon (90%), 1/2" gap

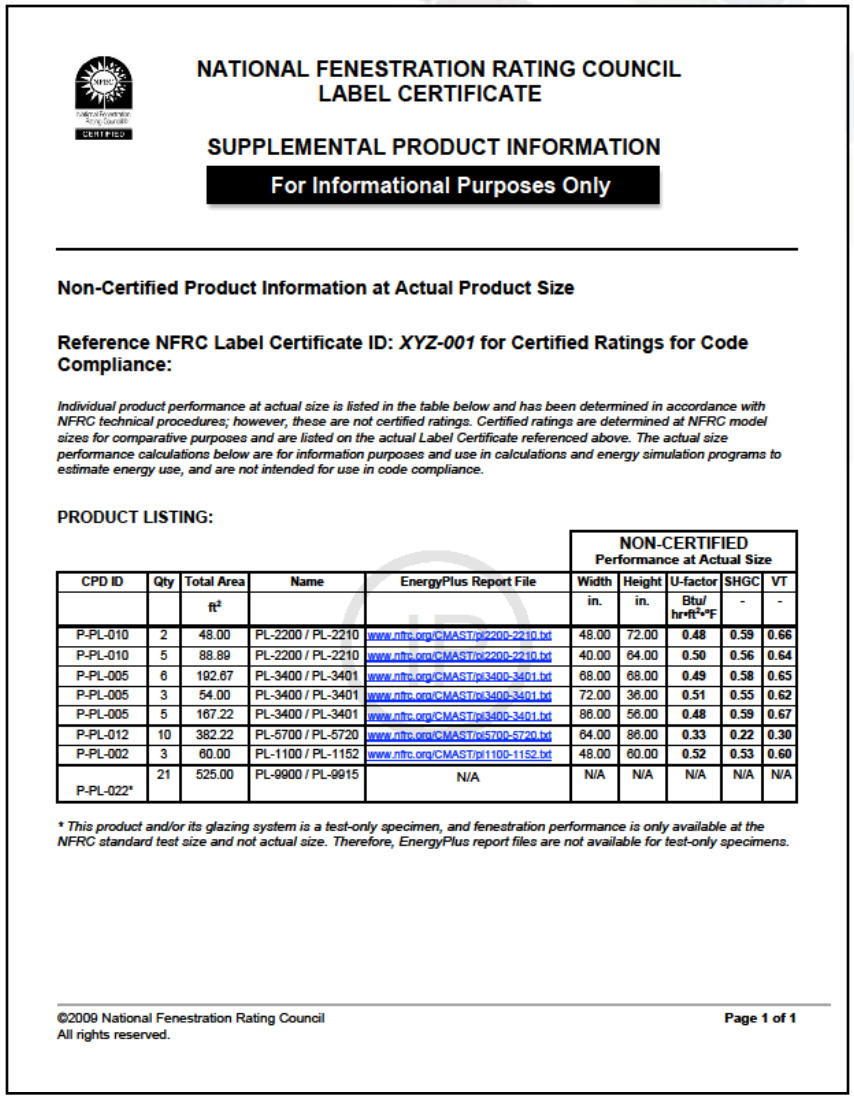
SPACER LISTING:

SPACER REF	SUPPLIER ID	DESCRIPTION
SA-AM-001		250P Mill Finish Aluminum Low profile (1/2")
SA-AM-002		15A Polymer Spacer (3/8")

National Fenestration Rating Council®

NFRC CMA Label Certificate *(optional pages):*

(project-specific sizes)



NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

SUPPLEMENTAL PRODUCT INFORMATION

For Informational Purposes Only

Non-Certified Product Information at Actual Product Size

Reference NFRC Label Certificate ID: *XYZ-001* for Certified Ratings for Code Compliance:

Individual product performance at actual size is listed in the table below and has been determined in accordance with NFRC technical procedures; however, these are not certified ratings. Certified ratings are determined at NFRC model sizes for comparative purposes and are listed on the actual Label Certificate referenced above. The actual size performance calculations below are for information purposes and use in calculations and energy simulation programs to estimate energy use, and are not intended for use in code compliance.

PRODUCT LISTING:

					NON-CERTIFIED Performance at Actual Size				
CPD ID	Qty	Total Area	Name	EnergyPlus Report File	Width	Height	U-factor	SHGC	VT
		ft²			in.	in.	Btu/hr·ft²·°F	-	-
P-PL-010	2	48.00	PL-2200 / PL-2210	www.nfrc.org/CMAST/pl2200-2210.txt	48.00	72.00	0.48	0.59	0.66
P-PL-010	5	88.89	PL-2200 / PL-2210	www.nfrc.org/CMAST/pl2200-2210.txt	40.00	64.00	0.50	0.56	0.64
P-PL-005	6	192.67	PL-3400 / PL-3401	www.nfrc.org/CMAST/pl3400-3401.txt	68.00	68.00	0.49	0.58	0.65
P-PL-005	3	54.00	PL-3400 / PL-3401	www.nfrc.org/CMAST/pl3400-3401.txt	72.00	36.00	0.51	0.55	0.62
P-PL-005	5	167.22	PL-3400 / PL-3401	www.nfrc.org/CMAST/pl3400-3401.txt	86.00	56.00	0.48	0.59	0.67
P-PL-012	10	382.22	PL-5700 / PL-5720	www.nfrc.org/CMAST/pl5700-5720.txt	64.00	86.00	0.33	0.22	0.30
P-PL-002	3	60.00	PL-1100 / PL-1152	www.nfrc.org/CMAST/pl1100-1152.txt	48.00	60.00	0.52	0.53	0.60
P-PL-022*	21	525.00	PL-9900 / PL-9915	N/A	N/A	N/A	N/A	N/A	N/A

** This product and/or its glazing system is a test-only specimen, and fenestration performance is only available at the NFRC standard test size and not actual size. Therefore, EnergyPlus report files are not available for test-only specimens.*

National Fenestration Rating Council®

Additional Resources

- NFRC Webpage: www.nfrc.org
- CMA Webpage: http://nfrc.org/sb_aboutprogram.aspx
- Labs and Agencies: http://nfrc.org/labsagencies.aspx
- NFRC Staff, Residential Product Certification Program Support:

  Toni Stroud — *PCP Associate, Product Certification Program, tstroud@nfrc.org*
- NFRC Staff, Commercial Product Certification Program Support

  Jen Padgett — *CMA Technical Coordinator, jpadgett@nfrc.org*

  Ray McGowan — *Sr. Program Manager, rmcgowan@nfrc.org*
- *Call (301) 589-1776 and ask for anyone*

National Fenestration Rating Council®

Thanks!!!

Ray McGowan

Senior Program Manager, National Fenestration Rating Council

240-821-9510, rmcgowan@nfrc.org

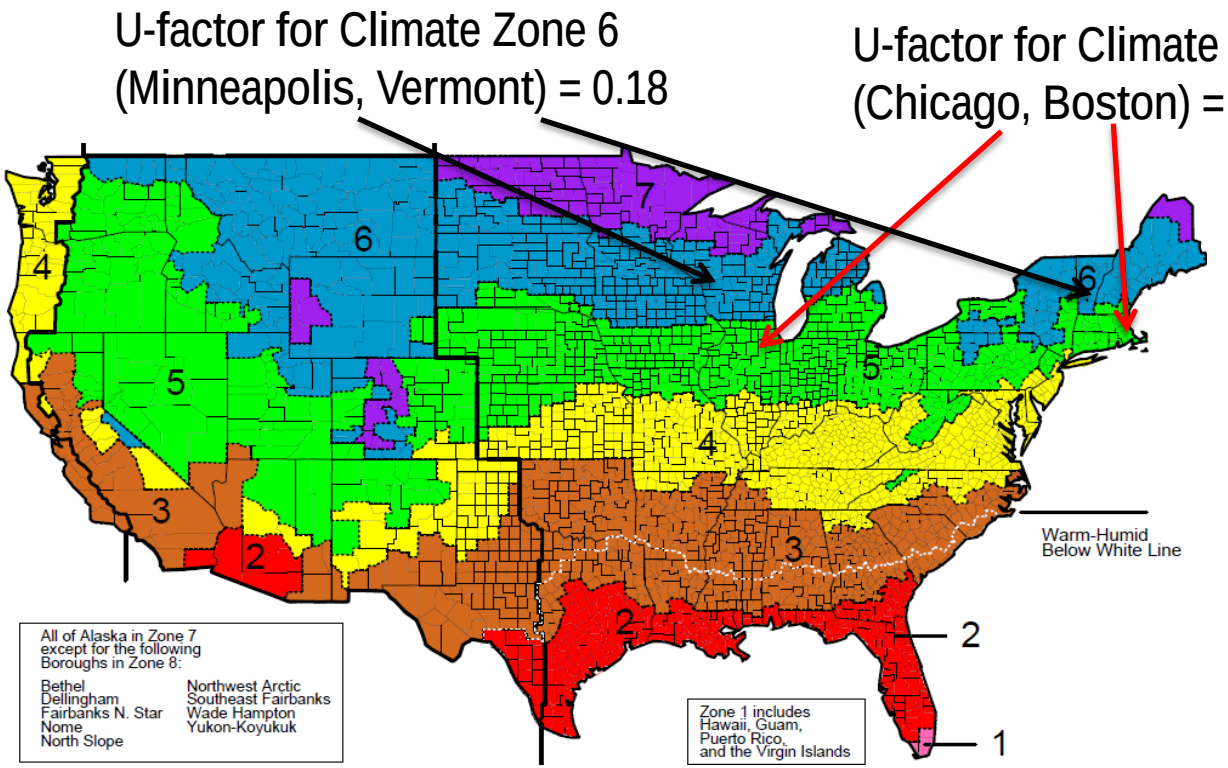
Extra Slides

Building Science Corporation (BSC) working with DOE's Building America

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

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



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*>

Program Results and Feedback

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

- 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 technologies …..at 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

Media Coverage and Support

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

- 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

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

Energy Trust of Oregon

Increased Visibility of R-5 Windows

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

- 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

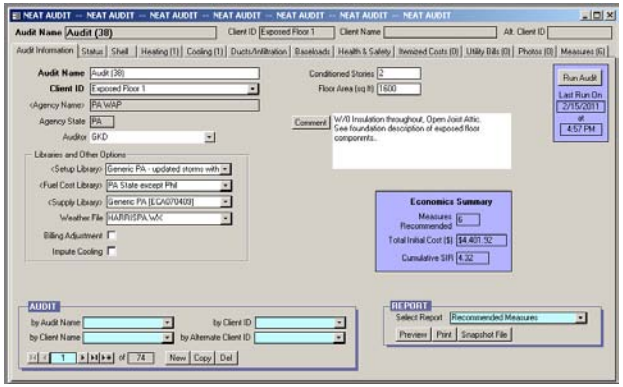
"R-5 and above windows represent a game-changing entry into the residential replacement window market and into the broader realm of energy efficiency retrofit options. While in the past, window replacement was not typically viewed as offering a good return on investment from an energy perspective, it 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

WVP Supports PA State Weatherization

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

- 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

WVP Supports PA State Weatherization

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/ft^2 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

Educational Workshops and Conferences

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

- 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