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Role of Highly Insulating Windows in Achieving 50% Energy Savings in Residential Retrofits

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Context

- Window products can be categorized into two groups:
  - Primary windows which fill the window cavity in a building envelope
  - Secondary (storm) windows which are installed inside (internal) or outside (external) of the primary window
- Home Energy retrofits are increasing, but window upgrades are generally not a commonly pursued measure due to:
  - High investment cost of primary windows
  - Low perceived cost-effectiveness
  - Lack of awareness about availability and cost of products
- When window retrofits are pursued, they are typically done for aesthetic reasons or to increase the value of the home
- Importance of windows for high performance new homes and retrofits often not emphasized
  - High performance, tight homes need to focus on windows to complete building envelopes
  - Significant impact on comfort
  - Potential for downsized HVAC, duct redesign and reduction, increased homeowner satisfaction, and reduced outside noise

Technical Approach

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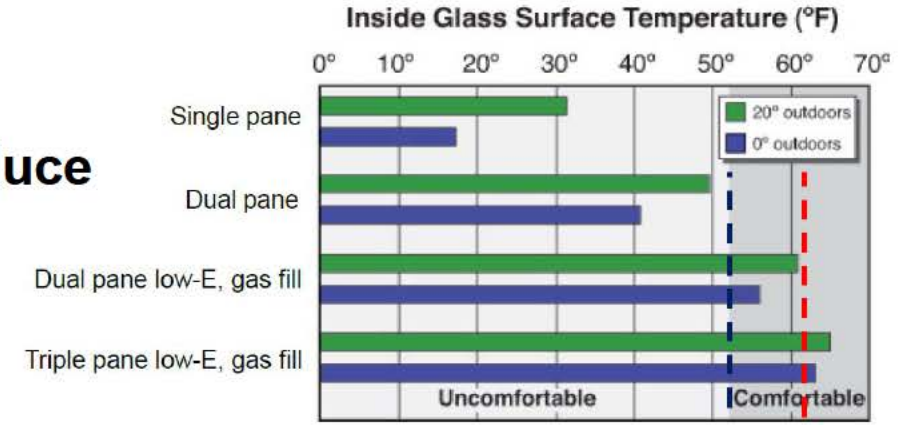
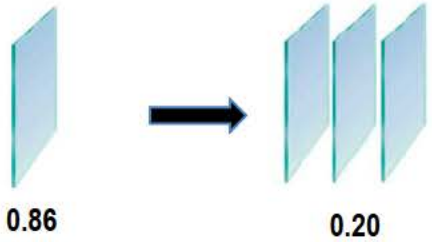
- Windows are 'holes' in a building's thermal barrier

2009 IECC Requirements for Climate Zone 5	
Wall Insulation	R-20
Ceiling Insulation	R-38
Window Insulation	~R-3

- Low-E coatings are a thin metal or metallic oxide particles which are applied to the glazing surface to **reduce radiant heat transfer** and increase **glass temperatures**

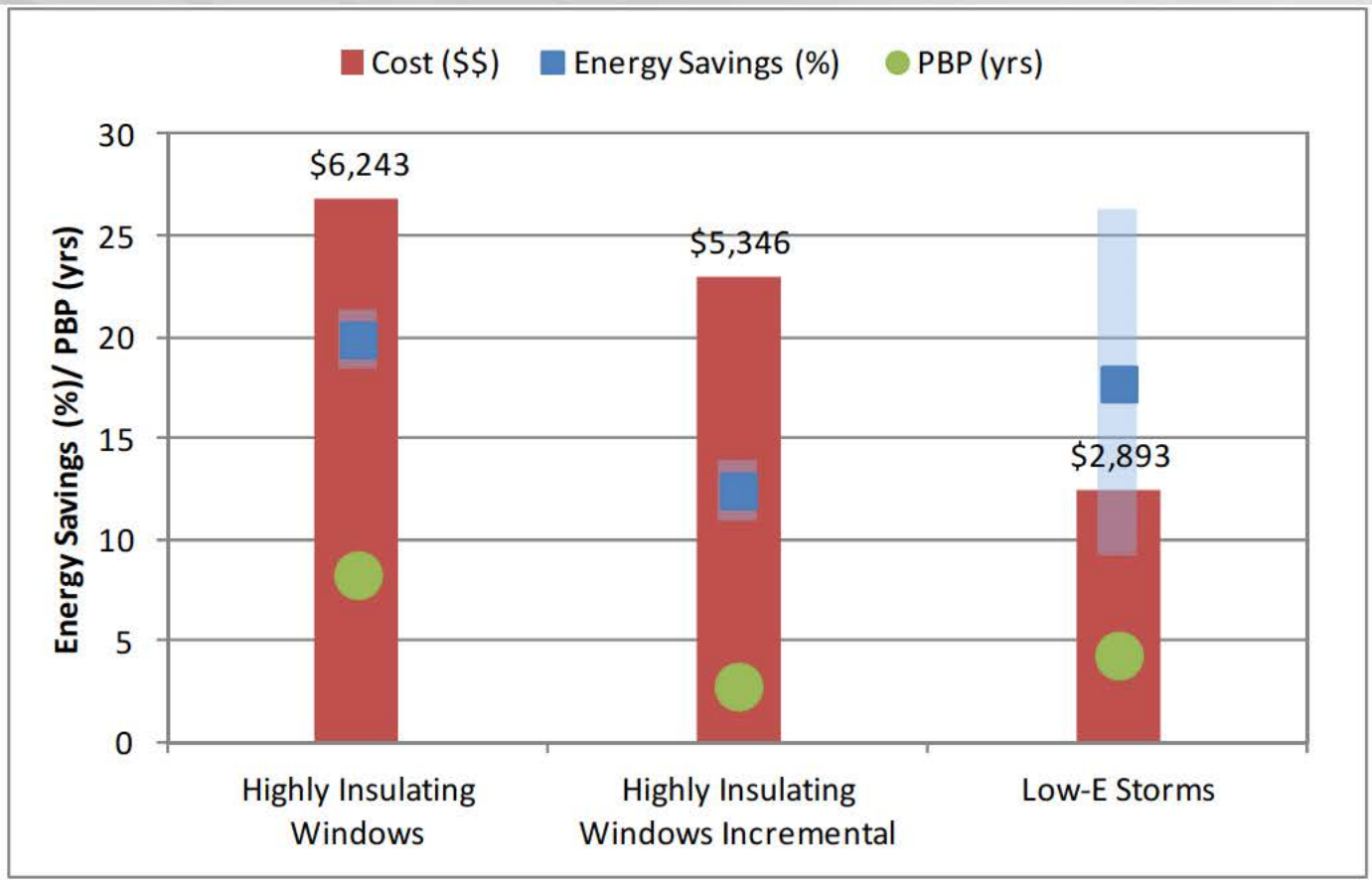




- Replacing single pane with high efficiency, Low-E primary window can reduce heat loss **up to 40%**

- Replacing single pane with low-E storm is equivalent to **code compliant window**

Recommended Guidance



- Continue to support highly insulating windows as a cost-effective measure for high performance new homes and deep retrofits
- Provide data on the performance of Low-E storm windows to support and develop programs offering these as a viable energy efficiency technology for retrofits

Value

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- Potential
  - Windows account for 10-13% of an average home's energy consumption[1]
  - Over 100 million homes with single or double pane clear glass
- Increased energy savings
  - Highly insulating, R-5 windows show 11.6% ± 1.53% whole house savings in Lab Home study, 19.8% heating energy savings
  - Preliminary results indicate 10-20% heating/cooling system savings in both cold and mixed climates
- Increased comfort and sound attenuation
  - Will lead to Increased homeowner satisfaction
- Cost-effectiveness
  - Primary windows cost effective when window replacement is necessary
  - Low-E storm windows cost-effective for upgrading existing window
- Potential for duct redesign, HVAC downsizing, and other non-energy efficiency benefits

[1] *2009 Buildings Energy Data Book*, U.S DOE; *2005 Residential Energy Consumption Survey*, U.S. DOE

Market Readiness

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- Commercially available technologies
  - More than 50 manufacturers available
    - Over 2% of all windows sold in 2011 were triple pane
    - Storm windows currently installed in 800,000 homes annually[2]
- Needs Building America assistance to:
  - Verify performance of highly insulating primary windows and low-e storm windows
  - Disseminate proven performance information
  - Assist in and provide data to support development of utility incentives and market-based programs
- Ultimate goal
  - Increase penetration of highly insulating windows and low-E storm windows
  - Contribute to 50% energy savings goal in residential retrofits

[2]NAHB Research Center, 2006 Consumer Practices Survey

Pros and Cons

	Primary Windows	Low-E Storms
Pros	• Potential for ~15% energy savings • Increased comfort • Potential for synergistic benefits	• Potential for 20% heating savings • Increased comfort • Low cost
Cons	• High installation cost	•Lack of awareness/education with utilities and homeowners about new products •Lack of regional distribution

References

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