

Highly-Insulating (R-5) Windows and Low-e Storm Windows Volume Purchase Program

What Home Buyers Need to Know

Windows have traditionally been a large source of heat loss within buildings. Substantial improvements have been achieved with insulating glass and low-E coatings, but the potential for even greater heating energy savings with highly-insulating windows still remains largely untapped.

What are Highly Insulating R-5 Windows?

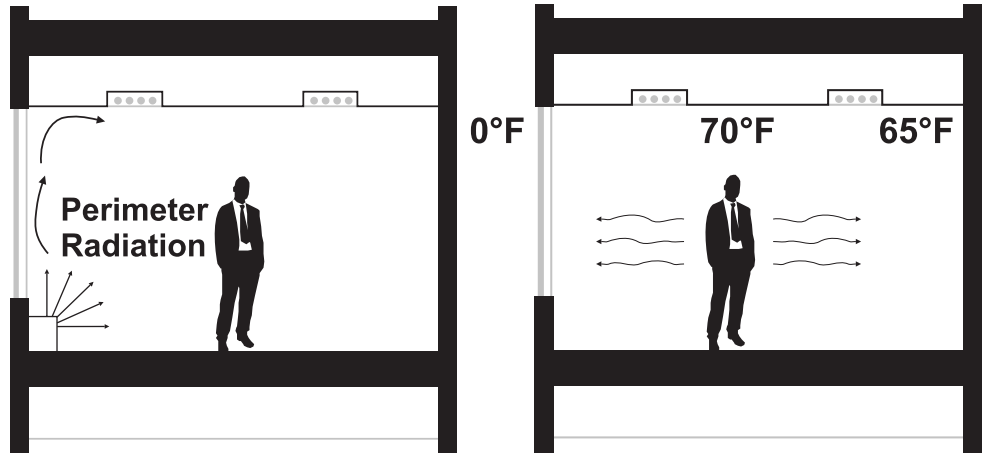
Highly-insulating windows with a whole-window R-value of 5 (a U-factor of around 0.2)¹ are the top tier of energy-efficient windows for cold and mixed climates available today. This compares to ENERGY STAR windows with an R-value of 3. Increasing the R-value from 3 to 5 reduces average heat loss through the window by 40%.

Energy Savings with R-5 Highly Insulating Windows

Windows in the U.S. account for 30% of building heating and cooling energy, representing an annual 4.1 quadrillion Btu (quads) of primary energy consumption. In addition, windows have a large impact on peak energy demand and on occupant comfort.

- In cold and mixed climates, R-5 windows save considerably more energy than conventional windows and can be cost effective when produced in volume.

* The U-factor measures heat transfer in Btu/hr-sq ft-°F. U-factor and R-value are inversely related.



(Left) Perimeter heat provided near windows may not be necessary with high-performance windows; (Right) Radiation from a warmer body to the colder glass causes discomfort because the two sides of the body have very different rates of radiant heat loss.

- Below, you can see how a home is affected by heat loss through windows. R-5 windows can often times eliminate the need for perimeter heat near windows as well as provide more overall comfort for occupants.

Overcoming Barriers to Widespread Adoption of R-5 Windows

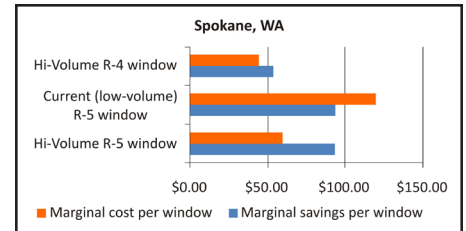
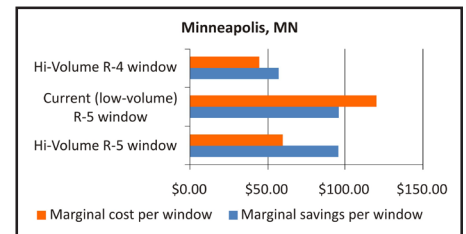
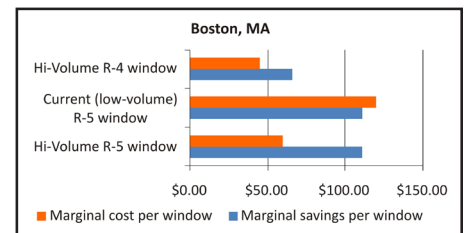
Principal barriers to widespread adoption of R-5 windows are cost, lacking economies of scale, and lacking awareness in the market. To overcome these barriers, the Building Technologies Program (BTP) of the Department of Energy (DOE) is employing a three-pronged strategy:

First, BTP is working with industry and potential buyers to drive down the production cost of R-5 windows. BTP is issuing production engineering awards to window manufacturers to achieve this goal without sacrificing performance. Second, in order to establish economies of scale, BTP is organizing a volume purchase of R-5 windows, and third, BTP is planning to build greater awareness of highly insulating windows by establishing more stringent ENERGY STAR criteria.

The figures on the right show the life-time energy cost savings and incremental cost of R-5 windows compared to typical

ENERGY STAR windows – assuming that through high-volume purchases, the price differential for R-5 windows is reduced from \$8/ft² to \$4/ft².

Marginal Cost vs. Marginal Savings for Highly-Insulating Windows in Cold Climates



Although presently, R-5 windows tend to be niche products that can be cost-prohibitive, there is a large energy and cost savings potential from volume demand and supply.

The Pathway to Zero Energy Buildings

The Building Technologies Program has embraced the strategic goal of developing net-zero-energy buildings to reduce national energy consumption. A net-zero-energy building is a residential or commercial building with greatly reduced needs for energy through efficiency gains (60 to 70% less than conventional practice), with the balance of energy needs supplied by renewable technologies. Highly insulating windows are a key stepping stone to achieving net-zero-energy buildings.

R-5 Windows Volume Purchase

A volume purchase involves a number of steps:

- Identification of buyer base including potential governmental and private sector customers
- Communication with manufacturers about appropriate technical and economic criteria based upon customer expectations
- Specification and interested manufacturers bid

Customers then have the opportunity to purchase the listed products from that web site. Manufacturers are able to lower their price at any time, but may not raise it, and are able to delist products at any time.

Schedule for volume purchase:

- Volume purchase RFP: December 2009
- Manufacturer proposals: February 2010
- Qualified vendors contacted: March 2010

- Window products available: Spring 2010 – mid 2011
- Phase II volume purchase: February 2011

Home Buyers Can Get Involved!

First time home buyers today can take advantage of a tax credit of up to \$8,000 for purchasing a principal residence on or after January 1, 2009 and before December 1, 2009. Unlike the tax credit enacted in 2008, the new credit does not have to be repaid. Home buyers can then purchase highly-insulating windows for home energy and cost savings and receive up to a \$1,500 tax credit for those purchases (applicable to ENERGY STAR windows).

Wisdom Way Solar Village

One successful example is Wisdom Way Solar Village, a small residential development comprised of 10 duplexes in western Massachusetts. These homes were designed and built to showcase energy efficient building performance at affordable price points. Duplexes of this project range in size from 2-bedroom units at 1,137ft² to 4-bedroom units totaling 1,773ft². Successful use of triple-pane R-5 windows in concert with an improved overall building envelope allowed for the scale-down from a conventionally sized heating system to a 12,000 Btu natural gas unit. This heating unit reduction represented a \$4,500 savings in the total cost of the system. Additionally, due to the superior insulating properties of the windows and overall envelope, occupants can expect to save over \$1,000 annually on energy. Despite a \$7,000 incremental cost for an enhanced building envelope—\$3,500 of which was spent on window upgrades—achieving building performance that allows for a more compact heating system can offset much of this incremental cost and significantly reduce the payback period.



More Advantages for Residential Buyers

In cold and mixed climates, home buyers can save energy and money through the use of R-5 windows which may result in considerable savings from a lower heating bill. Home owners can cost-effectively lower lifetime energy costs, while improving temperature uniformity and room comfort, and potentially acoustic characteristics. Depending upon their structure, three pane R-5 windows can moderately to significantly lower noise levels compared to standard two pane windows.

In the future, BTP will be providing additional support to help successfully transform the market for R-5 windows. This support will include a follow-on manufacturer production engineering solicitation to further improve performance and drive down costs, a Phase II volume purchase, and visibility and recognition mechanisms for builders who are early adopters of R-5 windows.

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