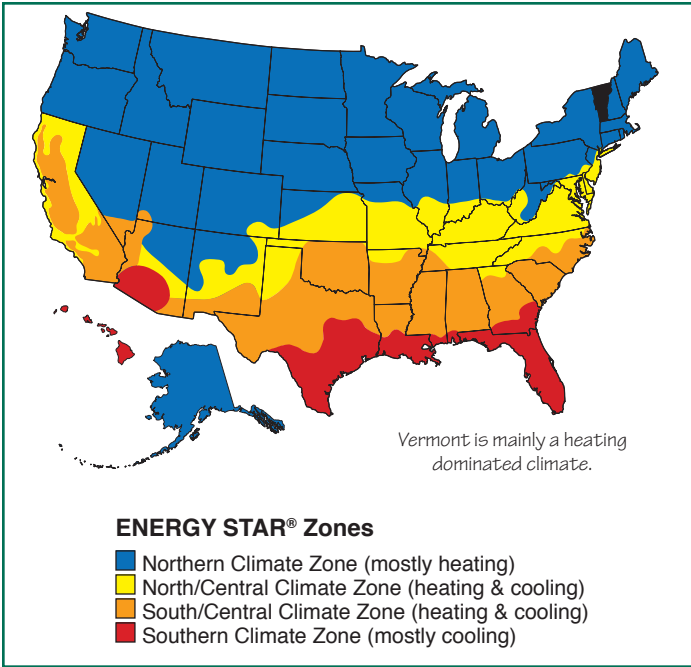




Existing Homes: Selecting Energy Efficient Windows in Vermont



Benefits of High Performance Windows

Heating and Cooling Season Savings

Low-E coatings, gas-fills, and insulating spacers and frames result in a lower U-factor, meaning less winter heat loss. Many low-E coatings also reduce solar heat gain.

Improved Daylight and View

Many low-E coatings can reduce solar heat gain significantly with a minimal loss of visible light (compared to older tints and films).

Improved Comfort

With a low U-factor, window temperatures are more moderate and there are fewer cold drafts. With a lower solar heat gain coefficient (SHGC), there is less discomfort from the summer sun.

Less Condensation

Frame, spacer and glazing materials that resist heat conduction do not become as cold and this results in less condensation.

Reduced Fading

Coatings on glass or plastic films within the window assembly can significantly reduce the ultraviolet (UV) and other solar radiation which causes fading of fabrics and furnishings.

Lower Mechanical Equipment Costs

Using windows that reduce solar heat gain (low SHGC) may allow for smaller, less expensive cooling equipment. Windows with a very low U-factor may ensure winter comfort even without the need for heat registers near the windows.



Visit www.efficientwindows.org for more information on the benefits of efficient windows, how windows work, how to select an efficient window, and what manufacturers provide efficient windows.

1. Meet the Energy Code and Look for the ENERGY STAR®

Windows must meet the locally applicable energy code requirements. Windows that are ENERGY STAR qualified typically meet or exceed energy code requirements. To verify if specific window energy properties comply with the local code requirements, go to Step 2.



2. Look for Efficient Properties on the NFRC Label

The National Fenestration Rating Council (NFRC) label is needed for verification of energy code compliance (www.nfrc.org). The NFRC label displays whole-window energy properties and appears on all fenestration products which are part of the ENERGY STAR program. For typical cost savings from efficient windows in a specific location, go to Step 3.

World's Best Window Co. Millennium 2001® 60x64 Wood Frame Double-Pane Window Product Type: Vertical Slider	
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./FPI)	Solar Heat Gain Coefficient
0.30	0.30
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance	Air Leakage (U.S./FPI)
0.51	0.2
Condensation Resistance	
51	-
<small>Manufacturers declare that these energy values in this ENERGY STAR label are determined using a computer simulation program that complies with the requirements of the International Energy Conservation Code (IECC) and the National Fenestration Rating Council (NFRC) and are based on the performance of a specific product type. NFRC does not warrant any product and does not warrant the quality of any product or any specific use. Consult manufacturer's literature for other product performance information.</small>	

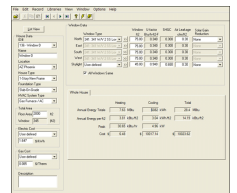
3. Compare Annual Energy Costs for a Typical House

Use computer simulations for a typical 2150 square-foot house to compare the annual energy performance of different window types. A comparison of the energy performance of a set of windows for this climate begins on Page 3.



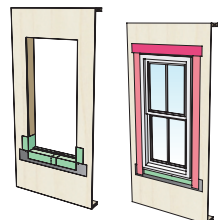
4. Customize Energy Use for a Specific House

A computer simulation program, such as RESFEN (windows.lbl.gov/software), lets you compare window performance options by calculating performance based on utility rates for your climate, house design options, and window design options.



5. Ensure Proper Installation

Proper installation is necessary for optimal window performance, to ensure an airtight fit and avoid water leakage. Always follow manufacturers installation guidelines and use trained professionals for window installation.





Look for the ENERGY STAR

Look for Efficient Window Properties on the NFRC Label



■ Northern Zone (mostly heating)

Recommendations in the Northern Zone (mostly heating)

U-factor	SHGC
Windows: $U \leq 0.30$ Skylights: $U \leq 0.55$ If windows provide good access to winter solar heat gain (SHGC 0.40 or higher and southern orientation), a U-factor of 0.32 is also acceptable. For superior insulation, windows with a U-factor of 0.22 or less are available.	No requirement. If air conditioning is not a concern, look for a high SHGC (0.30-0.60) so that winter solar heat gains can offset a portion of the heating energy need. If cooling is a significant concern and no shading is available, select windows with a SHGC less than 0.40. Select skylights with a SHGC of 0.40 or less.

Recommendations in the North/Central Zone (heating & cooling)

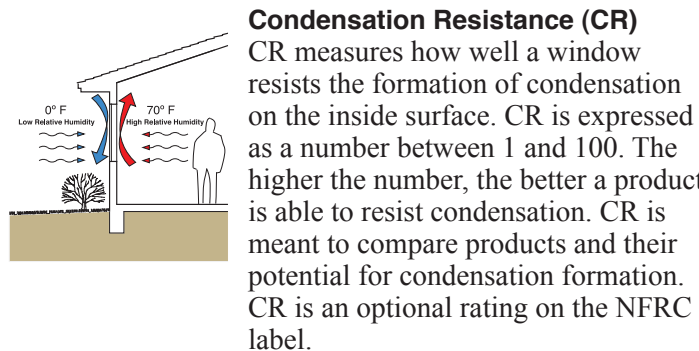
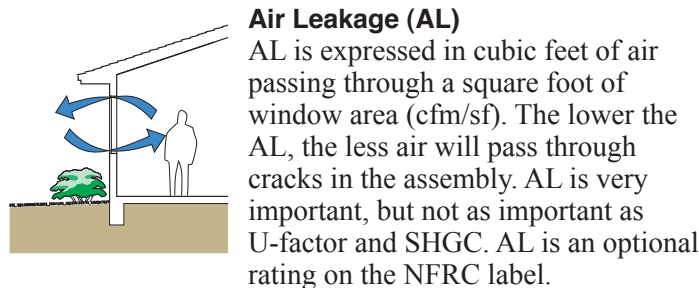
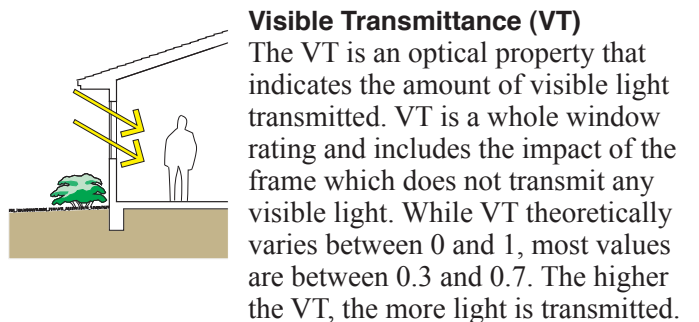
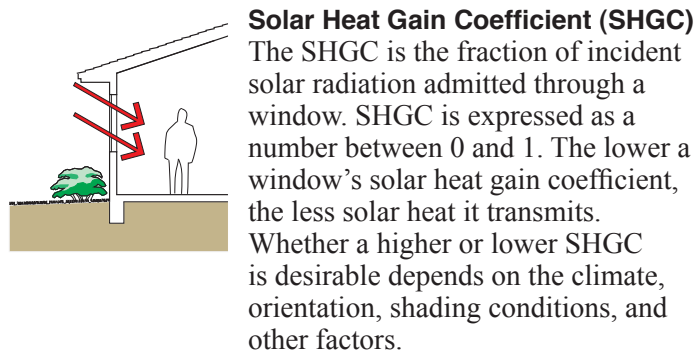
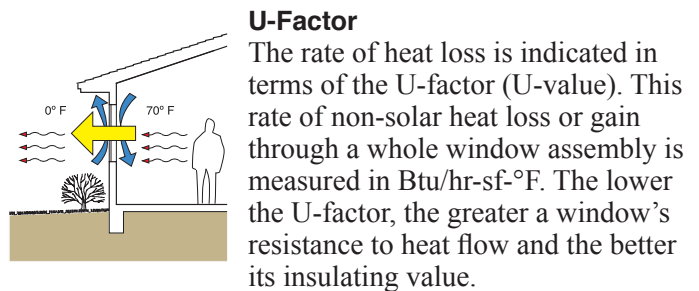
U-factor	SHGC
Windows: $U \leq 0.32$ Skylights: $U \leq 0.55$ The larger your heating bill, the more important a low U-factor becomes. For superior insulation, windows with a U-factor of 0.22 or less are available.	Windows: $SHGC \leq 0.40$ Skylights: $SHGC \leq 0.40$ If you have significant air conditioning costs or summer overheating problems, look for SHGC values of 0.30 or less. While windows with lower SHGC values reduce summer cooling demand, they also reduce free winter solar heat gain.

Recommendations in the South/Central Zone (heating & cooling)

U-factor	SHGC
Windows: $U \leq 0.35$ Skylights: $U \leq 0.57$ The larger your heating bill, the more important a low U-factor becomes.	Windows: $SHGC \leq 0.30$ Skylights: $SHGC \leq 0.30$ Windows with low SHGC values reduce summer cooling and overheating. However, they also reduce winter solar heat gain.

Recommendations in the Southern Zone (mostly cooling)

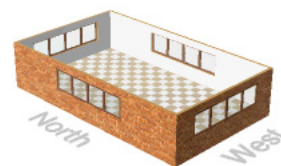
U-factor	SHGC
Windows: $U \leq 0.60$ Skylights: $U \leq 0.70$ A low U-factor is useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates.	Windows: $SHGC \leq 0.27$ Skylights: $SHGC \leq 0.30$ A low SHGC is the most important window property in warm climates.





Comparing Window Performance in Burlington, Vermont

The annual energy performance figures shown here assume a typical 2150 sq. ft. house built before 1990 with 15% window-to-floor area. The windows are equally distributed on all four sides of the house and include typical shading (interior shades, overhangs, trees and neighboring buildings).



Case Studies

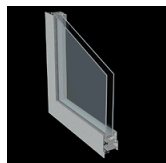
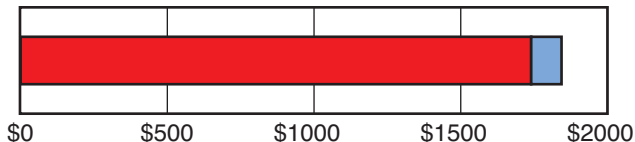


CASE 1
double glazing
clear glass
metal frame with thermal break

Properties

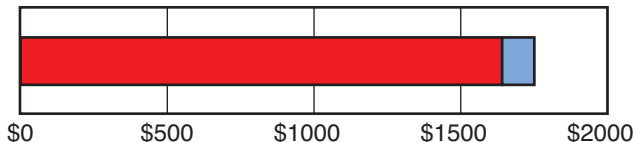
$U = 0.56-0.70$
 $SHGC > 0.60$

Annual Energy Use



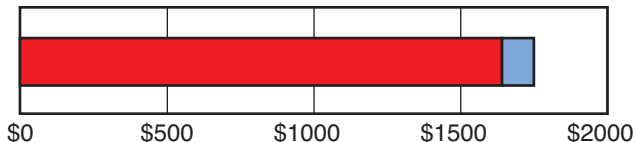
CASE 2
double glazing
low-E coating (high solar gain)
argon gas fill
metal frame with thermal break

$U = 0.41-0.55$
 $SHGC = 0.41-0.60$



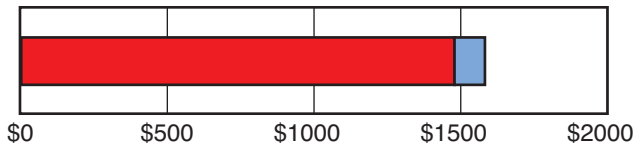
CASE 3
double glazing
clear glass
non-metal frame

$U = 0.41-0.55$
 $SHGC = 0.41-0.60$



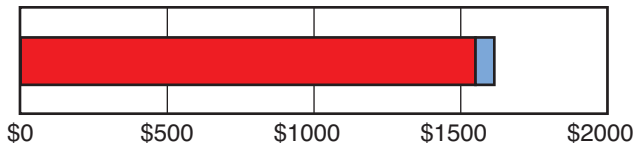
CASE 4
double glazing
low-E coating (high solar gain)
argon gas fill
non-metal frame
thermally improved

$U = 0.26-0.30$
 $SHGC = 0.41-0.60$



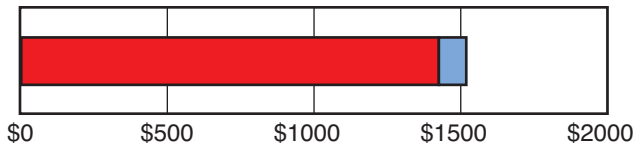
CASE 5
double glazing
low-E coating (moderate solar gain)
argon gas fill
non-metal frame
thermally improved

$U = 0.26-0.30$
 $SHGC = 0.26-0.40$



CASE 6
triple glazing
low-E coating (high solar gain)
argon gas fill
non-metal frame
thermally improved

$U \leq 0.20$
 $SHGC = 0.26-0.40$



Note: The annual energy performance figures shown here were generated with regression expressions provided by Lawrence Berkeley National Laboratory (windows.lbl.gov/ESStar2008). Results assume a typical 2150 sq ft house built before 1990 with 15% window-to-floor area. The windows are equally distributed on all four sides and include typical shading (interior shades, overhangs, trees, and neighboring buildings). U-factor and SHGC are for the total window including frame. The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Natural gas prices used are projections of the average natural gas price for the heating seasons of 2011-2020 in real 2009 dollars. Projections are based on state-specific natural gas retail price data by the Energy Information Administration (EIA) for the heating seasons of 2006-08 and are adjusted based on EIA projections of national natural gas price trends for 2011-2020. Electricity prices used are projections of the average electricity price for the cooling seasons of 2011-2020 in real 2009 dollars. Projections are based on state-specific electricity retail price data by the Energy Information Administration (EIA) for the cooling seasons of 2006-08 and are adjusted based on EIA projections of national electricity price trends for 2011-2020 (www.eia.doe.gov).