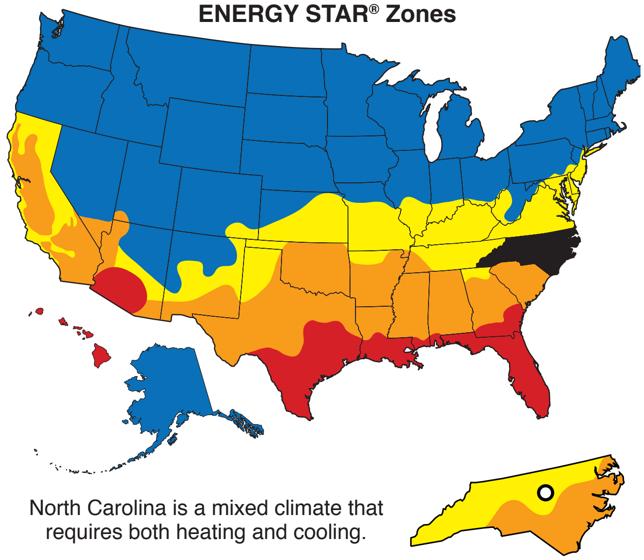
Efficient Windows Collaborative

Existing Homes: Selecting Energy Efficient Windows in North Carolina

www.efficientwindows.org | March 2013

ENERGY STAR® Zones



North Carolina is a mixed climate that requires both heating and cooling.

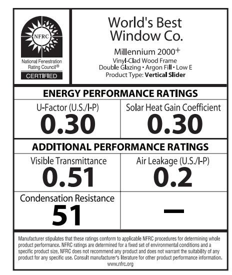
Northern Zone U-factor	Northern Zone SHGC
Windows: U≤0.30 **Skylights: U≤0.55** If windows provide good access to winter solar heat gain (SHGC 0.40 or higher and southern orientation), a U-factor of 0.32 is also acceptable. For superior energy performance, use windows with a U-factor of 0.25 or less.	**No requirement.** If air conditioning is not a concern, look for a high SHGC (0.30–0.60) so winter solar heat can help offset the heating energy need. If cooling is a significant concern and no shading is available, select windows with a SHGC less than 0.40.
North/Central Zone U-factor	**North/Central Zone SHGC**
Windows: U≤0.32 **Skylights: U≤0.55** The larger your heating bill, the more important a low U-factor becomes. For superior energy performance, use windows with a U-factor of 0.25 or less.	**Windows: SHGC≤0.40** **Skylights: SHGC≤0.40** Windows with low SHGC values help reduce summer cooling demand, but they also reduce free winter solar heat gain. If you have significant air conditioning costs or summer overheating issues, look for SHGC values of 0.30 or less.
South/Central Zone U-factor	**South/Central Zone SHGC**
Windows: U≤0.35 **Skylights: U≤0.57** A low U-factor is useful during cold days when heating is needed and is also helpful during hot days when it is important to keep the heat out.	**Windows: SHGC≤0.30** **Skylights: SHGC≤0.30** Windows with low SHGC values help reduce summer cooling demand, but they also reduce free winter solar heat gain.
Southern Zone U-factor	**Southern Zone SHGC**
Windows: U≤0.60 **Skylights: U≤0.70** A low U-factor is useful during cold days when heating is needed and is also helpful during hot days when it is important to keep the heat out.	**Windows: SHGC≤0.27** **Skylights: SHGC≤0.30** A low SHGC is an important window property in warm climates. For superior energy performance, use windows with a SHGC of 0.25 or less.

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

Windows must comply with your local energy code. 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.

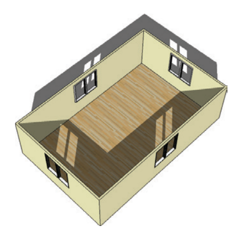
2. Look for Efficient Properties on the NFRC Label

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.



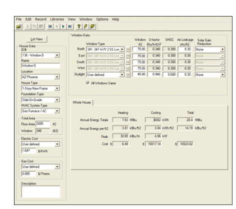
3. Compare Annual Energy Costs for a Typical House

Use computer simulations for a typical 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.



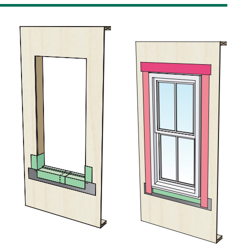
4. Customize Energy Use for a Specific House

A 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.



Benefits of High Performance Windows

Heating & Cooling Season Savings
In climates with a significant heating season, non-energy efficient windows can represent a major source of unwanted heat loss. Low-E coatings, gas fills, and insulating spacers and frames result in a lower U-factor, meaning less winter heat loss. In climates that mainly require cooling, non-energy efficient windows can be a major source of unwanted heat gain. Low-solar-gain low-E coatings can reduce solar heat gain while still providing comfort, daylight and views.

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

Improved Comfort
Efficient windows with new glazing technologies can make a home more comfortable. During heating seasons, exterior temperatures drive interior glass surface temperatures of poor-performing windows down below the room air temperature creating discomfort due to radiant heat loss and drafts. Windows with lower U-factors will result in a higher interior window temperatures in winter and thus greater comfort. During cooling seasons, strong direct sunlight can create overheating and discomfort. Windows with low-solar-heat-gain coefficients will reduce the solar radiation coming through the glass.

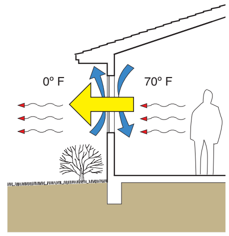
Less Condensation
Efficient windows create warmer interior glass surfaces, reducing frost and condensation. High-performance windows with warm edge technology and insulating frames have a warm interior surface so that condensation on interior surfaces is significantly reduced or eliminated.

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.

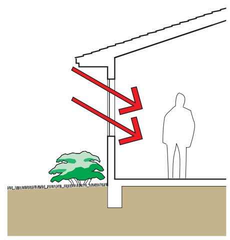
Lower Mechanical Equipment Costs
Efficient windows reduce annual heating and cooling bills as well as peak heating and cooling loads. Peak loads determine the size of the home's furnace, heat pump, air conditioner, and fans. Reducing peak load may allow homeowners to install a smaller heating or cooling system. Smaller HVAC systems cost less and can offset some of the cost of the efficient 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.

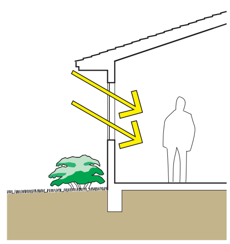
Efficient Window Properties



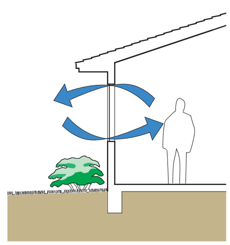
U-Factor
The rate of heat loss is indicated in terms of the U-factor (U-value). This rate of non-solar heat loss or gain through a whole window assembly is measured in Btu/hr-sf-°F. The lower the U-factor, the greater a window's resistance to heat flow and the better its insulating value.



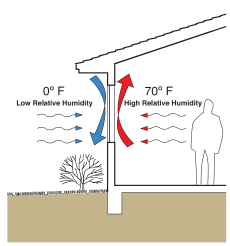
Solar Heat Gain Coefficient (SHGC)
The SHGC is the fraction of incident solar radiation admitted through a window. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits. Whether a higher or lower SHGC is desirable depends on the climate, orientation, shading conditions, and other factors.



Visible Transmittance (VT)
The VT is an optical property that indicates the amount of visible light transmitted. VT is a whole window rating and includes the impact of the frame which does not transmit any visible light. While VT theoretically varies between 0 and 1, most values are between 0.3 and 0.7. The higher the VT, the more light is transmitted.



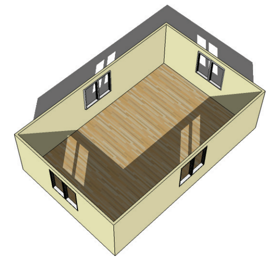
Air Leakage (AL)
AL is expressed in cubic feet of air passing through a square foot of window area (cfm/sf). The lower the AL, the less air will pass through cracks in the assembly. AL is very important, but not as important as U-factor and SHGC. AL is an optional rating on the NFRC label.



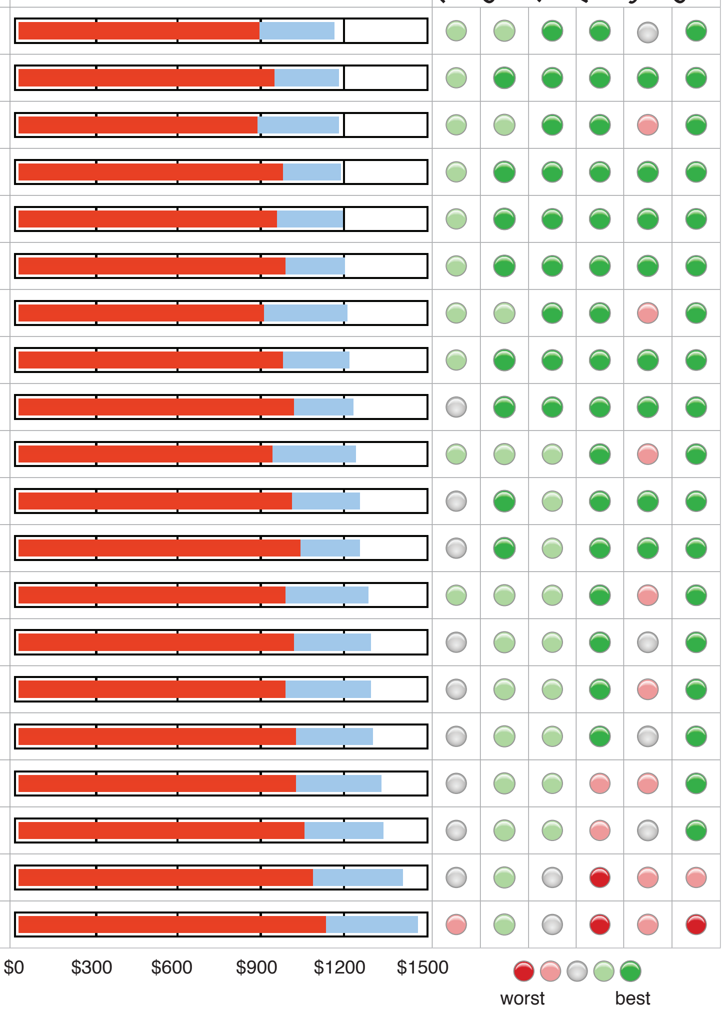
Condensation Resistance (CR)
CR measures how well a window resists the formation of condensation on the inside surface. CR is expressed as a number between 1 and 100. The higher the number, the better a product is able to resist condensation. CR is meant to compare products and their potential for condensation formation. CR is an optional rating on the NFRC label.

Comparing Window Performance in Raleigh, North Carolina

The annual energy performance figures shown here assume a typical existing 1700 sq. ft. single-story house with 15% window-to-floor area. The windows are equally distributed on all four sides of the house and include typical shading (partially deployed interior shades, overhangs, trees and neighboring buildings).



WINDOW SYSTEM							STANDARDS		PERFORMANCE	ENERGY			COMFORT		
ID	Panes	Glass	Frame	U-factor	SHGC	VT	ENERGY STAR	2012 IECC	Annual Energy Cost	Heat	Cool	Total	Winter	Summer	Cond.
18	3	HSG Low-E	Non-metal, Improved	≤0.22	0.41-0.60	0.41-0.50	No	Maybe							
19	3	MSG Low-E	Non-metal, Improved	≤0.22	0.26-0.40	0.41-0.50	Maybe	Yes							
15	2	HSG Low-E	Non-metal, Improved	0.23-0.30	0.41-0.60	0.51-0.60	No	Maybe							
20	3	LSG Low-E	Non-metal, Improved	≤0.22	≤0.25	≤0.40	Yes	Yes							
16	2	MSG Low-E	Non-metal, Improved	0.23-0.30	0.26-0.40	0.51-0.60	Maybe	Yes							
17	2	LSG Low-E	Non-metal, Improved	0.23-0.30	≤0.25	0.41-0.50	Yes	Yes							
9	2	HSG Low-E	Metal, Improved	0.41-0.55	0.41-0.60	0.51-0.60	No	No							
10	2	MSG Low-E	Metal, Improved	0.41-0.55	0.26-0.40	0.51-0.60	No	No							
11	2	LSG Low-E	Metal, Improved	0.41-0.55	≤0.25	0.51-0.60	No	No							
4	2	HSG Low-E	Metal	0.56-0.70	>0.60	>0.60	No	No							
5	2	MSG Low-E	Metal	0.56-0.70	0.26-0.40	0.51-0.60	No	No							
6	2	LSG Low-E	Metal	0.56-0.70	≤0.25	0.51-0.60	No	No							
13	2	Clear	Non-metal	0.41-0.55	0.41-0.60	0.51-0.60	No	No							
14	2	Tint	Non-metal	0.41-0.55	0.41-0.60	≤0.40	No	No							
7	2	Clear	Metal, Improved	0.56-0.70	>0.60	>0.60	No	No							
8	2	Tint	Metal, Improved	0.56-0.70	0.41-0.60	0.41-0.50	No	No							
2	2	Clear	Metal	0.71-0.99	>0.60	>0.60	No	No							
3	2	Tint	Metal	0.71-0.99	0.41-0.60	0.51-0.60	No	No							
12	1	Clear	Non-metal	0.71-0.99	>0.60	>0.60	No	No							
1	1	Clear	Metal	≥1.00	>0.60	>0.60	No	No							



Note: "HSG," "MSG," and "LSG" stand for high-solar-gain, moderate-solar-gain, and low-solar-gain respectfully. "Improved" includes warm-edge spacer technology and thermally improved frame. The annual energy performance figures shown here were generated using RESFEN6 provided by Lawrence Berkeley National Laboratory. 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 2009-2011. Electricity prices used are the average electricity price for the cooling seasons of 2007-2011. All pricing information provided by the Energy Information Administration (www.eia.doe.gov). A simple comfort analysis was performed using EPW weather files for each location to determine how often the winter night and summer day temperatures exceed beyond an acceptable number of hours. The room condition contains a large, west-facing window with a single person facing the window. A large window was used because a large view factor will have a greater impact on comfort. The two extremes of summer day and winter night conditions were only considered. A simple condensation analysis was performed using heating season design temperatures for each location, performance properties of the glazing system, edge performance properties of the framing system, and interior glass temperatures of a glazing system simulated in WINDOW6 to determine if the interior glass temperature falls to a level in which condensation may occur. See the www.efficientwindows.org for more information on all the energy, comfort, and condensations metrics.