How to Buy Energy-Efficient Residential Windows

Why Agencies Should Buy Efficient Products


- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.

- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy efficiency, while saving taxpayer dollars.

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations. Phone: (800) 363-3732 http://www.eren.doe.gov/femp/procurement

- DOE lists vendors of ENERGY STAR® windows and offers other information to help select energy-efficient residential windows. Phone: (800) 363-3732 http://www.energystar.gov

- Efficient Windows Collaborative provides information on energy-efficient windows, including a simulation software, RESFEN. Phone: (202) 530-2245 http://www.efficientwindows.org

- National Fenestration Rating Council (NFRC) lists energy performance of windows in the “NFRC Certified Products Directory.” Phone: (301) 589-6372 http://www.nfrc.org


- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation. Phone: (202) 484-0880 http://windows.lbl.gov

Definitions

SHGC, or Solar Heat Gain Coefficient, is a measure of the solar radiation admitted through a window. SHGC ranges between 0 and 1; the lower the number, the lower the transmission of solar heat. SHGC has replaced shading coefficient (SC) as the standard indicator of a window's shading ability. SHGC is approximately equal to the SC multiplied by 0.87.

U-factor is a measure of the rate of heat flow through a window. The U-factor is the inverse of R-value, or resistance, the common measure of insulation.

- Northern Mostly Heating
- Central Heating & Cooling
- Southern Mostly Cooling

The General Services Administration (GSA) will soon include residential windows in its Federal Supply Schedule 56-IV(A), “Construction and Building Materials.”

When contracting for residential windows, specify NFRC-rated SHGC and U-factor values that meet this Efficiency Recommendation for your geographic region. When buying commercially, look for windows with the EPA/DOE ENERGY STAR® label, all of which meet this Recommendation.
Several characteristics of windows affect their efficiency. Features that reduce winter heat loss (lower U-factors) include: insulated glazing units ("IG units"), with two or more panes; "low-e" (low-emittance) coatings, which minimize thermal radiation; low-conductance gas fills (usually argon or krypton); and low thermal conductance spacers and window frames. Weatherstripping in operable windows reduces air leakage (AL), which will soon be rated on NFRC labels (look for AL ratings of 0.30 or below). Energy-efficient windows also minimize occupant discomfort and decrease condensation.

An effective strategy to reduce summer heat gain is the use of windows with low-e coatings, especially spectrally selective low-e coatings, which reduce SHGCs and U-factors, but not visible light or color. Tinted windows may also reduce solar heat gain, although they transmit less visible light. Visible transmittance (VT) will also be rated on NFRC labels in the future.

To prevent air infiltration when outside temperatures are extreme, keep windows tightly closed and locked; this saves energy as well as preventing drafts. Interior shades and blinds can also help reduce unwanted solar heat gain.

### Windows Cost-Effectiveness Example

**1,540 sq. ft. house in Washington, D.C.**

<table>
<thead>
<tr>
<th>Performance</th>
<th>Base Model</th>
<th>Recommended Level</th>
<th>Best Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window Description</td>
<td>Double-paned, clear glass, aluminum frame</td>
<td>Double-paned, low-e coating, wood or vinyl frame</td>
<td>Triple-paned, tinted, two spectrally selective low-e coatings, krypton-filled, wood or vinyl frame</td>
</tr>
<tr>
<td>SHGC</td>
<td>0.61</td>
<td>0.55</td>
<td>0.20</td>
</tr>
<tr>
<td>U-factor</td>
<td>0.87</td>
<td>0.40</td>
<td>0.15</td>
</tr>
<tr>
<td>Annual Heating Energy Use</td>
<td>547 therms</td>
<td>429 therms</td>
<td>426 therms</td>
</tr>
<tr>
<td>Annual Cooling Energy Use</td>
<td>1,134 kWh</td>
<td>1,103 kWh</td>
<td>588 kWh</td>
</tr>
<tr>
<td>Annual Energy Cost</td>
<td>$287</td>
<td>$238</td>
<td>$206</td>
</tr>
<tr>
<td>Lifetime Energy Cost</td>
<td>$4,100</td>
<td>$3,400</td>
<td>$3,000</td>
</tr>
<tr>
<td>Lifetime Energy Cost Savings</td>
<td>$700</td>
<td>$1,100</td>
<td></td>
</tr>
</tbody>
</table>

**Cost-Effectiveness Assumptions**

The model shown above is the result of a simulation using a residential windows modeling program called RESFEN. Calculations are based on a prototype house: 1,540 sq. ft., two stories, a standard efficiency gas furnace and central air conditioner, and window area covering 15% of the exterior wall surface area (equally distributed around the house).

**Using the Cost-Effectiveness Table**

In the example above, new or replacement windows at the Recommended Level are cost-effective if their purchase price does not exceed the price of the Base Model windows by more than $700. Similarly, the Best Available windows are cost-effective if their price is no more than $1,100 above the price of Base Model windows.

**How do I assess the energy savings potential for my situation?**

RESFEN, which is available on the Efficient Windows Collaborative Web site (see "For More Information"), can estimate the heating and cooling costs for many house types, given an approximate knowledge of a few key parameters such as square footage, window area, heating and cooling types, and utility rates. Although the estimated energy costs may not always closely predict actual values, the differences between various window types is generally very accurate.
DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.