Energy Facts

Energy Efficient Windows

Windows can be one of your home's most attractive features. Windows provide outside views, daylight, ventilation, and solar heating in the winter. When properly selected and installed, windows can minimize a home's heating, cooling, and lighting costs. But they also can account for 10 – 25% of your winter heating bill through heat loss.

If your home has single pane windows--as almost half of the U.S. homes do--you might consider replacing them to conserve energy and save yourself money. New double pane windows made with high performance glass are available on the market. In colder climates, select windows that are gas filled with low emissivity (low-e) coatings on the glass to reduce heat loss. If you are building a new home, you can offset some of the cost of installing more efficient windows because you can install smaller, less expensive heating and cooling equipment. However, in older homes, it can take 20 years to recoup the cost of installing new windows through heating and cooling cost savings.

Controlling Air Leaks

Energy is wasted when air leaks in or out around windows, but you can reduce those air leaks. The least expensive options are caulking and weatherstripping, adding storm windows, or replacing window frames.

Caulking and Weather Stripping

Caulks are airtight compounds (usually latex or silicone) that fill cracks and holes. Before applying new caulk, you should remove old caulk or paint residue that remains around a window using a putty knife, stiff brush, or special solvent. After old caulk is removed, new caulk can be applied to all joints in the window frame and the joint between the frame and the wall. The best time to apply caulk is during dry weather when the outdoor temperature is above 45° F. Low humidity is important to prevent cracks from swelling with moisture. Warm temperatures are necessary so the caulk will set properly and adhere to the surface.

Weather stripping is a narrow piece of metal, vinyl, rubber, felt, or foam that seals the contact area between the fixed and movable sections of a windows joint. It should be applied between the sash and the frame, but should not interfere with the operation of the window. For more information on caulking and weatherstripping, ask for these Energy Facts sheets at your county MSU Extension office.

Storm Windows

Installing exterior or interior storm windows can reduce your heat loss through the windows by 25 – 50%. Storm windows should be weather stripped at all moveable joints.

Additional options to reduce heat loss and gain

Moveable insulation, such as insulating shades, shutters, and drapes can be applied on the inside of windows to reduce heat loss in the winter and heat gain in

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the summer. Shading devices such as awnings, exterior shutters, or screens can be used to reduce unwanted heat gain in the summer.

In most cases, these window treatments are more cost effective than purchasing energy efficient replacement windows and these options should be considered first. For information on energy efficient window treatment, call MSU Extension in your county and ask for Extension Bulletin E-888 titled Low Cost, Energy-Efficient Window Treatments.

Buying New Windows

Trying to determine which new, high tech windows to buy can be daunting. Standardized labels, required in only a few states, are supposed to make it easier to comparison shop for new windows. The National Fenestration Rating Council (NFRC) label may appear on new windows sold in Michigan even thought it is not required.

At present, only a window's U-factor must be labeled. Few window manufacturers participate in the federally sponsored Energy Star labeling program. The Energy Star labels use the data from the NFRC label and identify a window as suitable for a specific region of the country.

Window manufacturers use the term U-factor as a measure of thermal performance. **U-factor** describes a window's ability to conduct heat. Window ratings also give you the **R-value** that describes the insulating value. The higher the R-value (or the lower the U-factor), the more efficient the window will be in keeping your home cool in the summer and warm in the winter.

Window R-values range from 0.9 to 3.0 (U-factors from 1.1 to 0.35) and some highly energy efficient exceptions exist on the market. When comparing different windows, you should ensure that all U or R-values listed by manufacturers are based on current standards set by the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Also be certain the values are calculated for the entire window including the frame and not just for the center of the glass, and that the values represent the same size and style of window.

The following five factors affect a window's R-value:

- The type or glazing material (e.g. glass, plastic treated glass)
- The layers of glass
- The size of the glass
- The thermal resistance or conductivity of the frame and spacer materials
- The tightness of the installation

For more information on energy efficient windows, visit the National Wood Window and Door Association web site: http://www.nwwda.org

Types of Glazing Materials

Traditionally, clear glass has been the primary material available for windowpanes in homes. In recent years, several special glazing materials (specialty glass types) have appeared on the market to help control heat loss and condensation. Your selection will be based on the qualities that are most important to you and your particular home style and your local climate.

Low-emissivity (low-e) glass has a special coating to reduce heat transfer through the window. These coatings reflect from 40 – 70% of the heat that is normally transmitted out through clear glass back into the house but still allow the full amount of light and heat from the sun to pass through.

Heat absorbing glass contains special tints that allow it to absorb as much as 45% of the incoming solar energy, reducing heat gain. Some of the absorbed heat, however, passes through the window by conduction and re-radiation.

Reflective glass is coated with a reflective film and is useful in controlling solar heat gain during the summer. It also reduces the passage of light all year long, and like heat-absorbing glass, it reduces solar transmittance.

Plastic glazing materials--acrylics, polycarbonate, polyester, polyvinyl fluorides, and polyethylene--are widely available. Plastics can be stronger, lighter, cheaper, and easier to cut than glass. Some plastics also have higher solar transmittance than glass. However, plastics tend to be less durable and more susceptible to the effects of weather.

Glass Layers and Air Spaces

Standard single pane glass windows have very little insulating value (approximately R-1) and provide only a thin barrier to the outside that accounts for considerable heat loss and gain.

Double or triple pane windows have insulated air or gas-filled spaces between each pane and each layer of glass and air space resist heat flow. The width of the air spaces between the panes is important because air spaces that are too wide (more than 5/8 inch or 1.6 centimeters) or too narrow (less than 1/2 inch or 1.3 centimeters) have lower R-values. Advanced, multi-pane windows are manufactured with inert gasses (argon and krypton) in the spaces between the panes since these gases transfer less heat than air does. One caution: multi-pane windows are more expensive than single pane windows and can limit framing options.

Framing Materials

Window frames are available in a variety of materials. Frames can be composed of a single material or made of a combination of different materials such as wood clad vinyl or aluminum-clad wood. Each framing material has its advantages and disadvantages.

Though ideal for strength and customized design, aluminum frames conduct heat and therefore lose heat faster and promote condensation as well. The corrosion and electro-galvanic deterioration of aluminum frames can be improved by placing continuous insulating plastic stripes between the interior and exterior of the frame or the frames can be anodized or coated.

Wood frames have high R-values, are not affected by temperatures extremes, and do not generally promote condensation. Wood frames do require considerable maintenance in the form of periodic painting or staining. If not properly protected, wood frames can swell, which leads to rot, warping, and sticking.

Vinyl window frames made primarily from polyvinyl chlorides (PVC) offer many advantages. Available in a wide range of styles and shapes, vinyl frames have moderate to high R-values and are easily customized, competitively priced, and require very low maintenance. While vinyl frames do not possess the inherent strength of metal or wood, larger size windows can be strengthened with aluminum or steel reinforcing bars. Fiberglass frames are relatively new and are not widely available.

Sources:

Consumer Energy Information: EREC Fact Sheets, Energy-Efficient Windows, U.S. Department of Energy

Window Shopping: Consumer Report, October 2000, pages 42-45.

Energy Savers - Tips on Saving Energy and Money at Home, U.S. Department of Energy DOE/GO-10097-431, September 1997.

Definitions

U-factor - a thermal performance value that describers a window's ability to conduct heat; a lower value denotes efficiency.

R-values - a thermal performance value that describes a window's insulating ability - a higher value denotes efficiency.

Glazing materials - clear glass, specialty glass, or plastic-treated or coated glass; also plastics of various types used in windows.

Heat loss and gain - heat loss refers to losing heat (energy) out from the home in the winter; heat gain refers to gaining heat into the house in the summer from solar heating.

Emissivity - the relative ability of a surface to emit heat by radiation - low-e windows are those that reduce heat transfer from the house back outside, thereby losing energy.

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