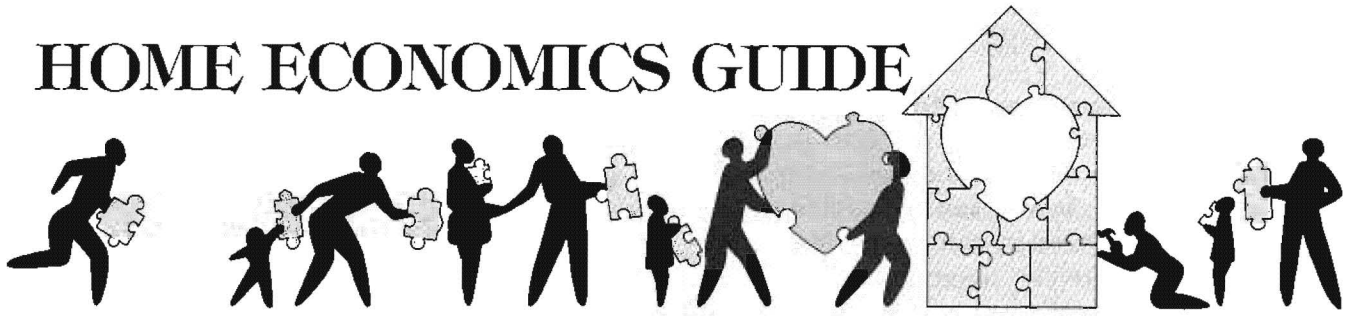
HOME ECONOMICS GUIDE



Shades and Shutters for Energy Efficiency

Windows provide your home with solar heat, daylight and natural ventilation. They also represent one of the greatest sources of heat loss and may account for up to 30% of your home's total heat loss in winter.

To cut these losses, you may want to insulate or improve the management of your windows. The basis for determining the effectiveness of insulation is its R-value or resistance to heat flow. In Missouri, recommended R-values for home insulation are R-30, ceilings; R-19, walls; and R-13, floors. For comparison, consider that a single-glazed window has an R-value of about 1 and a double-glazed window (or window with storm), about 2; in other words, nearly twenty times more heat escapes through each square foot of window than through an insulated wall. Based on current costs of materials from which window coverings are made, an R-value of 4 is considered cost effective. With this R, the product has about 75% efficiency, which means it stops 75% of the heat loss through the window.

Heat losses occur by **infiltration** when there are cracks around the frame or glass. Heat is **conducted** through glass rapidly when it warms the glass and is transmitted to the colder outside environment. **Convection** losses occur as the air between the window and the treatment cools; this cooled air drops down pulling heated air over the top to be cooled and the cycle repeated. **Radiation** is the process of losing heat through space. For example, a person seated near an uncovered window will begin to chill as their body heat radiates to cold glass surfaces.

Insulation Value of Windows and Window Treatments

Table 1

	R-value
Single glazing, bare[1]	.8 - 1.0
Double glazing, bare	1.8 - 2.0
Single glazing, loose drapery[2]	1.10
Double glazing, pulled shade	2.05
Double glazing, sealed drapery	2.35
Double glazing, insulated shutters	9.50 or more*
Double glazing, insulated quilt, one layer polyester fiberfill	4.55
Double glazing, insulated quilt, three layers of polyester fiberfill	6.75

[1]ASHRAE Handbook of Fundamentals, 1981, ASHRAE, Inc., New York, NY.
[2]*Insulating Windows: The Inside Story,* Gwen Cukierski
* R-value will depend on R-value of insulation and other materials used in the construction as well as that of the window on which it is used.

The first step in your management plan should be to correct infiltration problems. This can be done with caulking, weatherstripping or some combination of storm windows. Once these weatherizing materials have been applied and storm windows are in place, attention should be given to effective inside window coverings. Your selection of treatments should reflect a balance between control of function, improved efficiency and an appearance that meets your satisfaction and budget.

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There are two basic types of energy-efficient interior window treatments—the rigid insulating panel or shutter and the thermal shade.

Rigid insulation board can be styled as a pop-in panel and placed in windows at night for a simple and relatively inexpensive form of movable insulation. Hinged or bi-fold shutters can be attached to the window frame similar to decorative louvered shutters. These shutters can be made using loose-fill insulation, hardboard covering and wood framing, or rigid foam insulation and plywood covering. They can be covered and decorated with paint, stain, fabric or wallpaper.

Thermal shades can be made from a variety of materials using reflective surfaces or insulated with batting fibers, fiberfill, and operated like an ordinary roller shade or Roman shade. Common materials and the manufacturer's advertised insulating values are listed below.

Insulating Materials

Table 2

Foylon	R = 2.02
Fiberfill, 1 layer	R = 2.5
2 layers	R = 4.0
3 layers	R = 5.5
Window fleece	R = 4.0
Hollofil	R = 2/inch thickness
Polar Guard	R = 3.5/inch
Thinsulate	R = 4 per ¾ inch
Warm Window	R = 7.5+ (includes single glazing)
Window Quilt	R = 4.25 (includes single glazing)
Window Comforter	R = 5.0+ (includes single glazing)
Texolite®	R = 7.0+ (includes single glazing)

Energy efficiency has become big business and new products appear constantly. The buyer should note whether the R-value stated on window treatments is the manufacturer's own or the results of independent testing.

Effective R-values depend on good construction and proper installation and management; loss of value may be due to degradation of materials and air infiltration around and through the product.

What Is an Insulated Treatment?

To be effective an insulated treatment must include these features:

- **A method of reducing conductive and radiant heat loss by increasing the insulating quality.** Determine the R-value of the product you have chosen. Standards exist but estimates may be based on conditions which are difficult to duplicate. Many manufacturers quote R-values including double or single glazing; subtract the appropriate R-values (table 1) to determine value of the product itself. Shades will rely on fiber battings which trap air for insulation value; panels and shutters can be constructed with R-values close to that of the surrounding wall. An R 4 to 5 is considered minimum in order to make the treatment worth your time, effort and expense. Review Table 2 for sample R-values.

- **A continuous tight seal at the edge of the treatment** to prevent room air from circulating behind it. Gaps in the seal can result in losses in R-value. Sealing can be made with magnetic strips, fabric tape (Velcro), aluminum, plastic or wood strips, or patented shield, tract or channel systems. Shutters and panels can be designed to require only weatherstripping on the edge for a proper seal.

- **A vapor barrier on the room side** to prevent moisture in the air from passing through the window treatment. If warm moist air condenses within the product or on the glass, it can reduce insulation qualities and cause damage to wood frames and window sills. Vapor barriers for shades should be as light and as flexible as possible, but strong enough to withstand repeated openings. Many rigid products are faced with a material which reflects heat and serves as a vapor barrier. Suitable materials include 2- to 4- mil polyethylene and vinyl, mylar film, Foylon, Tyvek, some vinyl wall coverings, certain paints and aluminum foil. Vapor barriers are correctly installed facing the warm inside room and are found immediately behind the face fabric or decorative covering.

Window Treatment Management

The effectiveness of a well-designed insulated window treatment will depend greatly on management. Daily operation of insulated coverings is necessary and soon will become routine. Otherwise, just a storm window will perform better than a higher-rated treatment which is used only occasionally.

In the winter, there are about 16 hours a day when windows aren't performing their intended function. They are instead an enormous heat drain which provides a good reason for finding ways to insulate them.

Winter

South windows—Open the window treatment for the 6 best hours of sunshine. These windows gain more heat during the day than they lose at night. Night insulation is very effective.

East and West windows—Open the window treatment for the 3 best hours of sunshine. Solar heat is gained through east windows during morning hours and through west windows in late afternoon.

North windows—Close unless there is sun in morning or evening. North windows receive no direct sunlight and are always losing heat.

Summer

All window coverings closed all hours the air conditioner is operating. If air conditioner is not in use, close those windows and window treatments receiving direct sunlight. Use shaded windows for ventilation.

Other Considerations

Safety—Many insulating treatments incorporate substantial quantities of plastic foam and films and synthetic fibers. If exposed to extreme heat or flame, these may constitute a smoke and fire hazard. During a fire, some foam products may give off a toxic fume; these products should be covered with fire-retarding material such as hardboard or plywood. (The International Fabricare Institute has this information on wet side applications to improve the flame retarding of fabrics: mix a solution of 7 ounces of borax with 3 ounces of boric acid per gallon of water. Immerse items in solution for 5 minutes. Lightly extract excess solution and air dry. Home applications may be thorough and the family should be aware that retardants reduce flame spread; they do not prevent burning.)

Windows are often used as an emergency exit. Coverings which obscure the window location and whose operation is not apparent may present a safety hazard to family members and visitors. All families should install smoke detectors throughout the house.

Appearance and Operation—Will the window coverings coordinate with the existing or planned interior design? Many people will reject a product if it has an unfamiliar appearance. Check the seals and controls. Are these convenient and easy to operate?

Installation and Maintenance—Multiple layers, composite layers and dissimilar materials require special handling. Fiber batting may fuse if ironed. Drycleaning solvents can destroy tape adhesive. Water washing may cause uneven shrinkage. Check the manufacturer's information carefully. Fabric-covered window treatments may be sprayed with a soil retardant and cleaned regularly with the appropriate vacuum cleaner attachment. Installation must be precise for effective edge sealing. If you have professional installation it should be included in payback calculations. Also include your hidden costs of gathering supplies and materials for do-it-yourself projects. Pop-in panels will need to be stored when not in position.

Payback—At this writing, insulating window treatments are considered temporary devices and may not be eligible for federal tax credits as are storm windows which are considered permanent devices.

Simple payback can be calculated by dividing the total cost of the project by the yearly savings. Depending on where you live in Missouri, adding an R-value of 4 to a double-glazed window can save from 40 cents to 60 cents (1983 fuel costs) a square foot of window area each year, depending on cost of fuel used. Not reflected in these figures is the escalating cost of fuel and the affect on comfort level when cold window surfaces are covered.

A useful formula for **estimating** yearly savings is this:

$$\frac{\text{R added}}{\text{R existing} + \text{R added}} \times \text{DD} \times 24 \times \frac{1}{\text{R existing}} \times \text{square feet} = \text{BTUs saved per heating season}$$

R added = the insulating value of the window treatment you are considering.

R existing = the insulating value of your bare window (see Table 1).

DD = the number of heating degree days where you live. Your electric utility or a heating contractor should be able to provide this.

24 = 24 hours each day.

Square feet = area of the window to be covered.

For example:

(window quilt) (DD Columbia) (hrs/day) (area)

$$\frac{4.25}{2 + 4.25} \times 5078 \times 24 \times 1/2 \times 15 = 621{,}547 \text{ BTUs}$$

(existing window)

At $12.50 per million BTUs (or $1.25 per 100,000 BTUs), your yearly savings at that window would be about $7.50. Divide this figure into the cost of the new window treatment to find the payback period in years.

Summary

Use this checklist to evaluate different window treatment options, either purchased commercially or home constructed.

Rating	Yes	No
Does it provide a minimum R added of 4?	____	____
Is there a provision for a continuous side seal?	____	____
Is there a vapor barrier present directly behind the decorative or face fabric?	____	____
Is it possible or convenient to open and close treatment as needed?	____	____
Have you protected potentially harmful materials from contact with heat and flame?	____	____
Can the products be easily removed and easily cleaned?	____	____
Can you afford special installation and cleaning?	____	____
Does the appearance of the product please your family?	____	____
Does it coordinate with your decor and furnishings?	____	____
Is the cost of the product (or materials) justified when compared to the value of energy saved?	____	____

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