Housing
Fact Sheets

Energy Saving Window Treatments

Windows are a major source of heat loss but, of course, they are necessary for light, ventilation, and view. In a typical single family home, 25% to 35% of the heat is lost through windows.

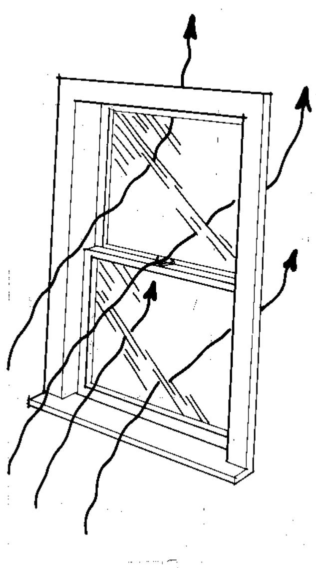

Figure 1

A single pane window loses 20 times as much heat as the same area in an adjacent well insulated wall, and a double-glazed window loses ten times as much. However, windows <u>can</u> be a source of solar heat gain if they are strategically placed and properly installed and if energy efficient interior window treatments are used.

The addition of insulating treatments to windows is very cost-effective and should be the next step after the following measures have been taken

- Turning back the thermostat at night from 68° to 60°.
- Adding insulation to un-insulated ceiling (to R-49) and walls (to R-11 or R-19).
- Adding storm windows to single glazing; and caulking and weather-stripping all crevices.
- Keep the heating system properly maintained for peak efficiency.

Some of the heat loss through a window is due to infiltration of cold air around the window. This can be reduced by caulking and weather-stripping. These measures are very cost-effective and will help ensure the success of insulating interior treatments.

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Window heat loss also occurs through radiation, convection, and conduction. **Radiation** is heat passed from a warm object to a cooler object. Heat always moves from warm to cool. If you are near a cold window, your body heat will radiate to the cooler window, making you feel cold.

Convection is heat transfer through a fluid such as air or water. Air infiltration through cracks around the window increases convective air movement and heat loss. This explains why caulking and weather-stripping to reduce air movement also reduce heat loss.

Conduction is heat transfer through solids. Glass is a good conductor of heat and therefore a poor insulator. Heat readily passes through glass (Figure 1). Using insulating treatments on windows can reduce all types of heat loss. In cold climates such as New York State, heat loss in winter is the major concern, although energy can also be saved by reducing solar heat gain in the summer.

Methods for Reducing Window Heat Loss

After caulking and weather-stripping have been completed, the use of double-glazed or storm windows should be considered. A double-glazed window loses only half the heat of a single-glazed window and is cost effective. Triple glazing reduces the heat loss another 30 percent but usually is not cost-effective. Each additional layer of glass reduces the solar heat gain. For cold climates, the most energy-efficient window is double-glazed with an operable R-5 interior treatment. (R-value represents resistance to heat loss. The higher the R-value, the better the insulating value of the material.) On south-facing windows the treatment should be opened during the day for solar heat gain and properly closed at night. Treatments on north windows may be left closed 24 hours a day for increased efficiency.

A variety of interior window treatments, if properly installed and used, can be effective in reducing window heat loss. Included are roller shades, draperies, insulating Roman shades, venetian blinds, and insulating panels or shutters. Some are more energy efficient than others. The choice depends on the location of the window, the use of the room, the aesthetics, the effectiveness and cost, and thus the payback period.

To be effective, all window treatments must trap and hold air between the treatment and the window. To accomplish this the treatment must be tightly fitted at all edges and should be placed about one inch from the glass.

Roller Shades

The common roller shade that has been in use for many years is a very effective energy saver, when properly installed. The effectiveness is due to the shade's ability to block air flow and to form an insulating layer of air.

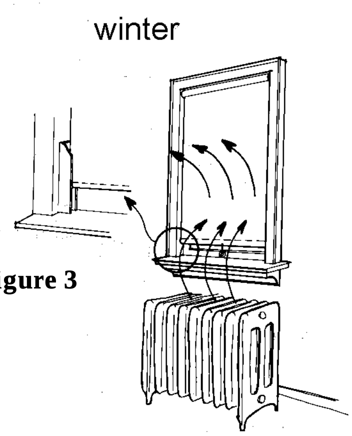

Figure 3

Figure 2

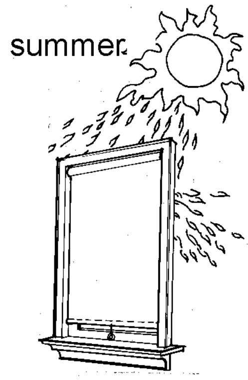

Figure 4

A conventional roller shade mounted inside the frame with no more than 1/4 inch gap at the sides and touching the sill (Figure 2) will reduce heat loss by about 27 percent. By adding side tracks (Figure 3) the efficiency may be increased to 45 percent. An inside-mounted shade with a reflective coating also may be 45 percent effective.

To be most efficient, a window shade must be:

- Installed with side tracks for a tight fit,
- Placed one inch from the glass (inside mount),
- Covered with a reflective material facing the glass.

A shade meeting these conditions will be approximately 55 percent effective[1].

The reflective material made of un-coated aluminum such as Foylon, is more effective than aluminized polyester film or fabric that has a plastic coating over the aluminum.

The opaqueness or translucency of the shade can contribute to its efficiency. An opaque shade will be slightly more efficient than a translucent shade.

Shades on a sunny window should be raised in winter to permit solar heat gain in daytime, then lowered at night to prevent heat loss. Just the opposite is true in summer (Figure 4).

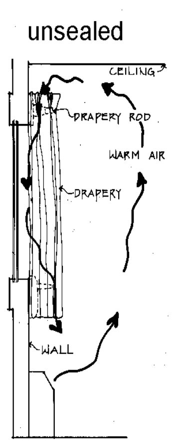

Figure 5

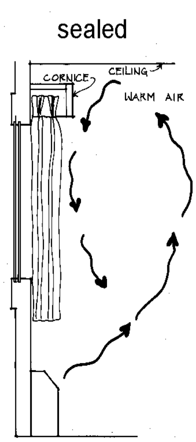

Figure 6

Draperies

Conventionally hung or unsealed draperies are not efficient energy savers. They will reduce window heat loss no more than 10 percent. This is due primarily to the movement of air by convection through the "tunnel" between the drapery and the glass. Warm air enters at the top of the drapery, moves toward the floor as it is cooled by the glass, enters the room and is warmed, then rises and repeats the cycle (Figure 5). To be more efficient, draperies should be sealed at all four edges.

[1] The percent effectiveness indicates the heat loss reduction achieved when the window treatment is installed over a single glazed window.

This may be accomplished by closing the top (Figure 6) to reduce heat loss by the "tunnel" effect, sealing both sides, permitting the drapery to touch the sill or floor and having a four inch overlap at the center. This type of installation will reduce heat loss by convection. Experiments have shown that lined draperies installed in this manner will be up to 25% effective. The method of installation is more important in reducing heat loss than the type of fabric, although the fabric must have low air permeability, meaning that little or no air could pass through the fabric. A separate lining is recommended because the incorporated layer of air has some insulating value.

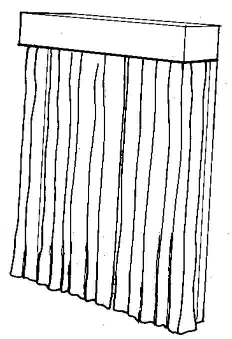

Figure 7

A closed top cornice installed over the top of the drapery (Figure 7) is one way to reduce heat loss by the tunnel effect. The cornice may be covered with the drapery fabric, with wallpaper, or it may be stained or painted.

To take advantage of solar heat gain, the drapery should be opened during the day and closed at night to prevent heat loss.

An inside-mounted roller shade, installed as previously described, in combination with sealed draperies, would yield an R-value of 1.6, including a single pane window. This translates to about 40% effective. Because of their high cost and low R-value, draperies are not as cost- effective in energy savings as other treatments.

If a warm air register is below the window, the warm air should be prevented from entering between the drapery and the glass. A metal or plastic deflector can be placed over the register to direct the air out into the room. A deflector may also be used over a radiator, although this heat is not moving as fast as forced air heat.

Insulating Roman Shades

Insulating Roman shades offer another choice for energy efficient interior treatments. These consist of flat pieces of fabric with rings sewn on the back and operated with a pull cord causing the fabric to stack in horizontal folds at the top of the window when the shade is open (Figure 8). They consist of a center layer of insulating material, a vapor retarder on the room side, a decorating fabric on the room side and a lining on the back. The shade should be sealed at the sides, top, and bottom.

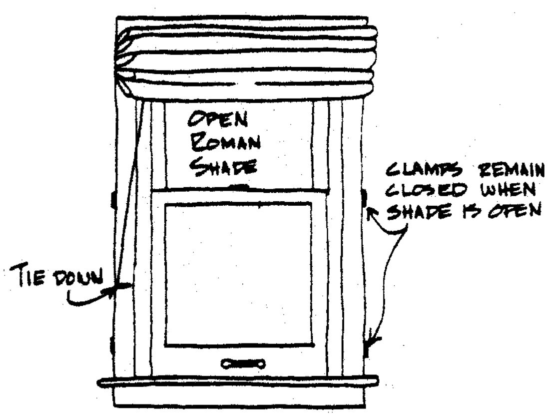

Figure 8

For greatest efficiency the seals must be **continuous** - not just sealed at intervals. A hinged 1" x 2" wood clamp (Figure 8) at the sides makes an effective seal. This shade can be as high as 60-75 percent effective, with an R-value of approximately 4.

Venetian Blinds

Standard venetian blinds are not effective in preventing heat loss. They do, however, allow excellent control of daylight and ventilation. Some manufacturers are making blinds with insulated interlocking slats that are more energy efficient, but very expensive.

Insulating Panels and Shutters

Insulating panels and shutters are another window treatment option. Panels are removed from the window and stored elsewhere or left in place over the window continuously for the heating season (Figure 11). They can be used where daylight, view, and ventilation are not as essential as reducing heating loss. Shutters are attached to each window frame and remain in place whether opened or closed (Figure 9 & 10). The hardware and design are variable: hinged with center opening, hinged with side opening, hinged with top or bottom opening; bifold; or sliding. The choice of hardware and design is determined by the window size, shape, and location in the house.

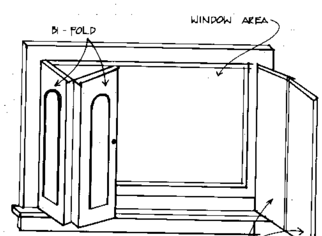

Figure 9

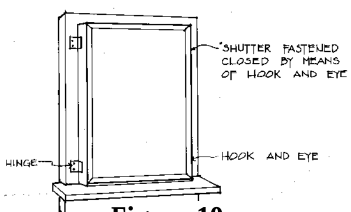

Figure 10

Insulating shutter and panel materials vary tremendously. Unlike other insulating options described previously, they are usually rigid and are often made of common building materials. Do-it-yourselfers will find that simple carpentry skills and hand tools are necessary to build this type of window treatment.

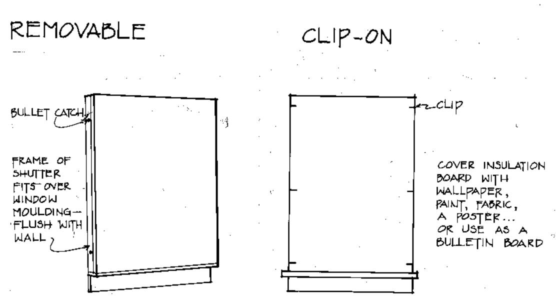

Figure 11

A typical insulating shutter or panel might consist of a center insulating core made of rigid foam boards; a bag of cellulose or other loose-fill insulation; or even a series of insulating materials and air spaces.

This insulating core may be covered on both or one side by a sheathing material that gives the shutter or panel rigidity and strength. Sheathing materials include plywood, hardboard, and other thin rigid materials. Next, on the side of the panel/shutter that faces the room, a vapor retarder is added. Finally a decorative material is applied.

The insulating panel or shutter materials are usually encased in a framework made of wood or extruded plastic. This provides strength, rigidity, and a means for attaching hardware and weather-stripping.

The R-value of this type of insulating window treatment varies tremendously and may be as high as R-10, or about 90% effective. A typical R-value is 4.0 which provides 75% effectiveness. The total R-value of the shutter/panel is found by adding the separate R-values of materials and incorporated air spaces.

Commercially Available Window Treatments

A variety of energy-saving window treatments is available commercially. In general they fall into three categories; glazing treatments, operable products, and non-operable panels.

- Glazing treatments resemble a second layer of glass and have similar a R-value. Clear polyethylene sheets that are placed over the window opening and sealed are one example.
- Operable products are those that can be opened and closed daily. An insulated window shade is an example of a roll-down treatment. Shutters are another type of operable treatment.
- Non-operable panels are those that stay in place during the heating season.

Before choosing a window treatment consider the type of window, its location, the aesthetics of the treatment and the initial cost.

The chart on the following page shows a comparison of the efficiency of the different types of window treatments. Remember this: **a window treatment is effective only when it traps and holds air between itself and the window.**

The following instructions for making window treatments may be obtained from your county Cornell Cooperative Extension office:

Modifying Draperies to Conserve Energy

Installing an Energy Efficient Roller Shade

Making an Insulated Roman Shade

Constructing and Installing Thermal Shutters and Panels

EFFECTIVENESS OF WINDOW TREATMENT IN REDUCING HEAT LOSS

(All treatments assume installation over a single glazed window.)

Type of Window Treatment	Approximate % Reduction in heat loss	Approximate R-value
Roller shade with inside mount, no more than 1/4" gap at sides	24-31%	1.32-1.4
Roller shade, reflective coating, inside mount	45%	1.8
Roller shade, side track, and/or 1" from glass (inside mount)	40-45%	1.67-1.8
Roller shade, side track, reflective coating and 1" from glass (inside mount)	55%	2.22
Drapery, conventionally hung on traverse rod	5-10%	1.05-1.10
Drapery, tightly woven fabric, separate lining, sealed at all four edges	25%	1.33
Venetian blind	6-7%	1.07
Roman shade, 2 layers fabric, plastic vapor retarder and insulating material	65-75%	3.0-4.0
Do-it-yourself shutter, insulating core, sheathing material vapor retarder and decorative covering	75-90%	4.0-10.0
Clip-on 1/2" rigid insulation board with spun glass batt insulation between board and window	75-90%	4.0-10.0
As a Comparison		
Double pane window, bare	50%	2.0
Double pane window, low e-coating	68%	3.3
Wall, 3 1/2" spun glass insulation	94%	16.6
Wall, 6" spun glass insulation	96%	25.0

Thanks to Gwen Cukierski and Regina Rector, former Extension Associates, for their assistance in preparing this fact sheet.

Reviewed and revised,
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