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EC80-2052 Window Treatments for Energy Efficiency

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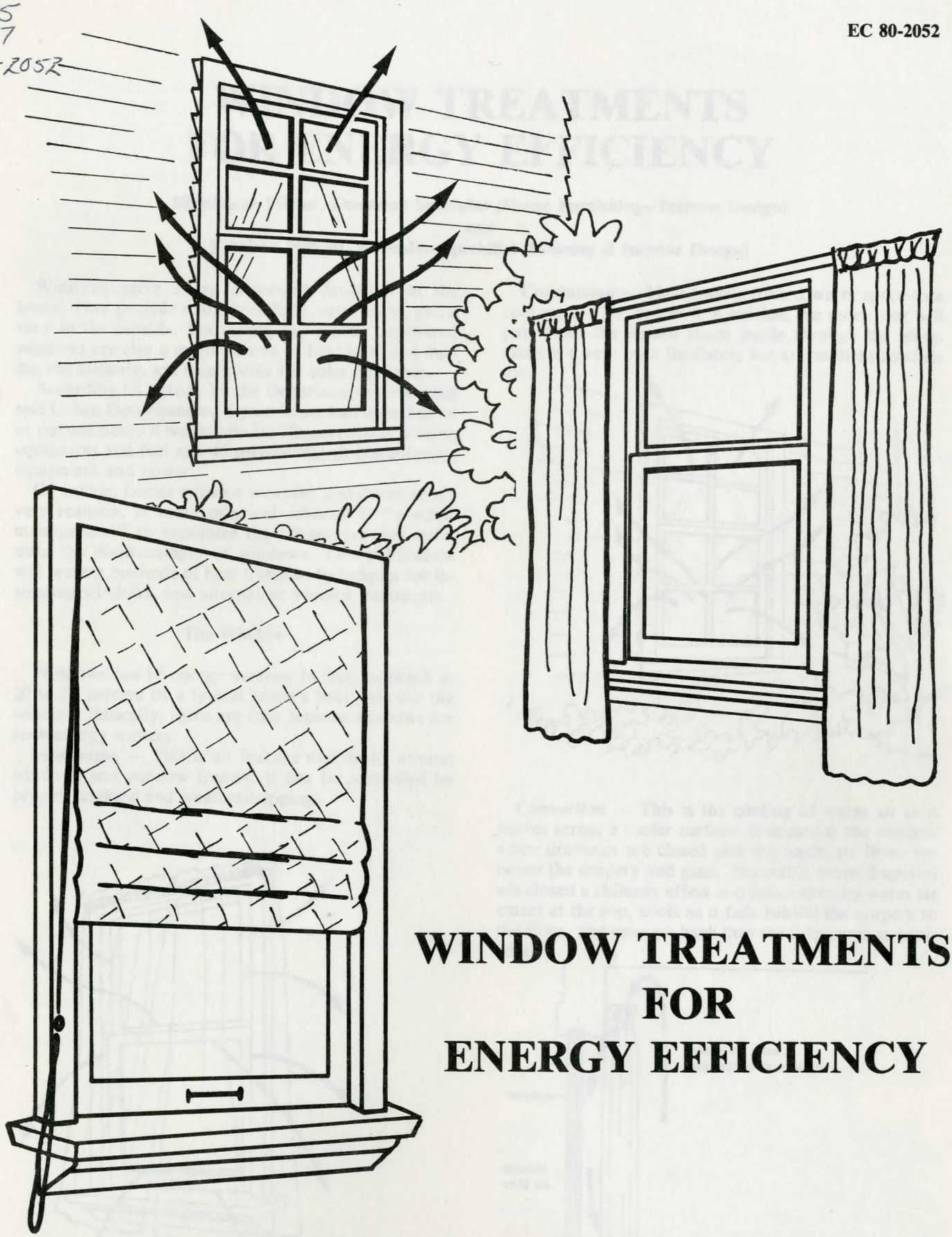

WINDOW TREATMENTS FOR ENERGY EFFICIENCY

EXTENSION WORK IN "AGRICULTURE, HOME ECONOMICS AND SUBJECTS RELATING THERETO,"
THE COOPERATIVE EXTENSION SERVICE, INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES,
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LEO E. LUCAS, DIRECTOR

WINDOW TREATMENTS FOR ENERGY EFFICIENCY

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Windows serve many important functions in the home. They provide a source of light, ventilation, and a view to the outside. But during the winter, uncovered windows are also a major source of heat loss, and during the summer, are responsible for solar heat gain.

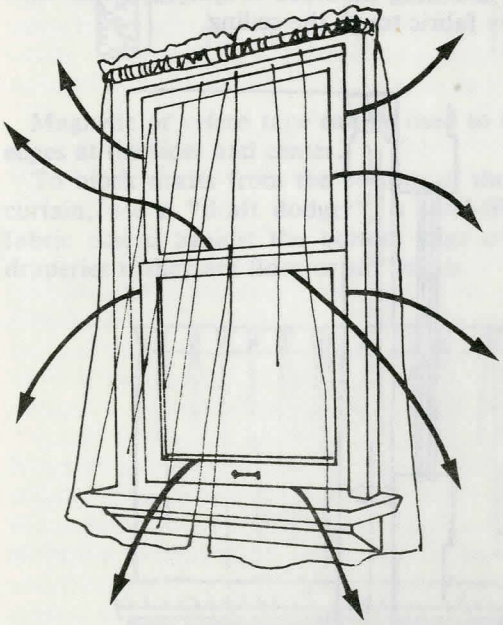
According to a study by the Department of Housing and Urban Development, if your home had no windows or outside doors it would require 70 percent less heating equipment and fuel and 46 percent less air conditioning equipment and power.

Of course, homes without windows and doors aren't very realistic. A more practical solution is "window management" to maximize the advantages and minimize the disadvantages of windows. This publication will present methods of heat transfer, techniques for insulating windows, and alternative window treatments.

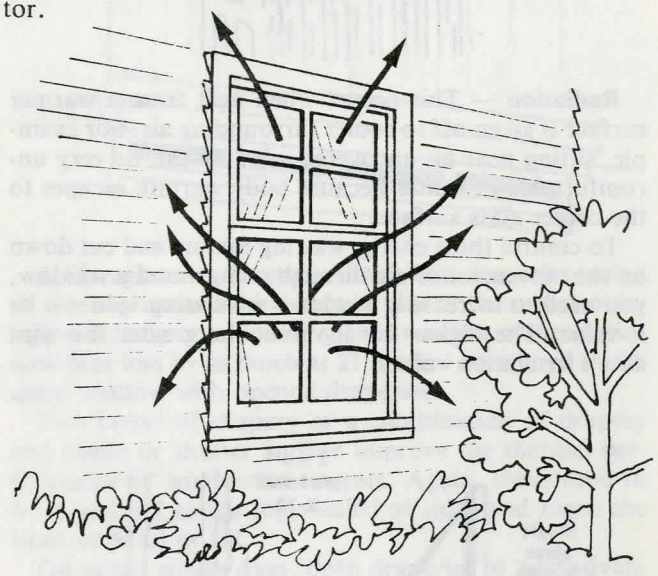
The Window

Windows can be energy wasters. In fact, as much as 20 to 50 percent of a typical home's heat goes out the window. Basically, there are four reasons windows are such energy wasters:

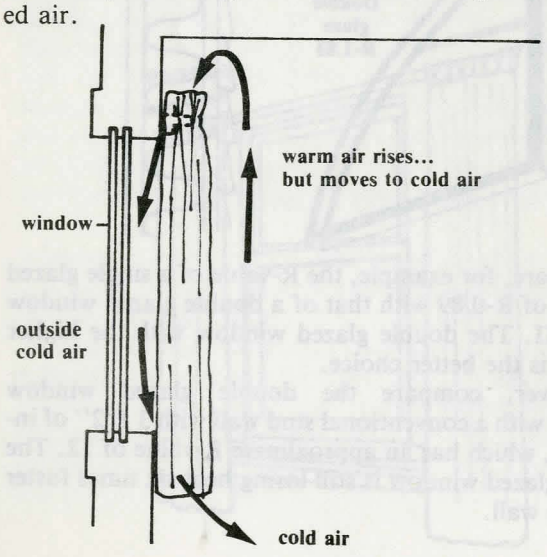
Infiltration — This is air leakage and drafts around windows and window frames. It can be controlled by proper caulking and weatherstripping.

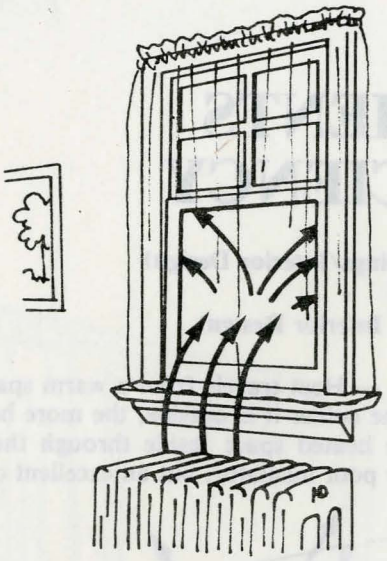


Conduction — Heat travels from a warm space to a cold space. The colder it is outside, the more heat will pass from the heated space inside through the glass. Glass is a very poor insulator, but an excellent conductor.



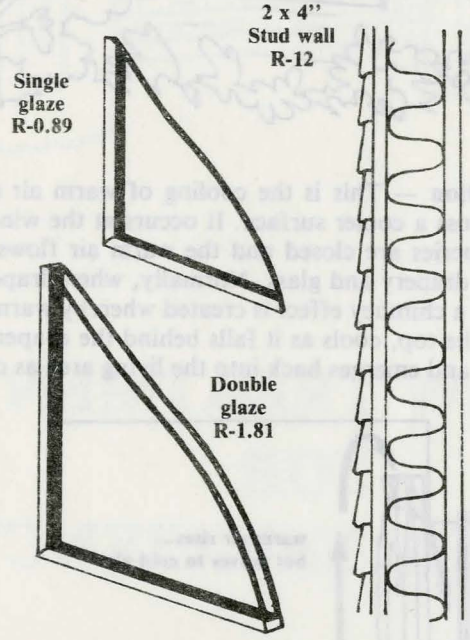
Convection — This is the cooling of warm air as it moves across a cooler surface. It occurs at the window when draperies are closed and the warm air flows between the drapery and glass. Normally, when draperies are closed a chimney effect is created whereby warm air enters at the top, cools as it falls behind the drapery to the floor, and emerges back into the living area as cooled air.





Radiation — This occurs when heat from a warmer surface is given off to cooler surrounding air. For example, sitting near an uncovered window can be very uncomfortable in winter because body warmth escapes to the cooler glass surface.

To control these energy wasting factors and cut down on the movement of air through and around a window, you need to increase a window's insulating value — or R-value. The higher the R-value, the greater the window's insulation value.



Compare, for example, the R-value of a single glazed window of R-0.89 with that of a double glazed window of R-1.81. The double glazed window with the higher R-value is the better choice.

However, compare the double glazed window (R-1.81) with a conventional stud wall with 3 1/2" of insulation, which has an approximate R-value of 12. The double glazed window is still losing heat six times faster than the wall.

So, to increase the R-value of a window and save energy, additional measures must be taken.

Interior Window Treatment

While window treatments can be as diverse and distinctive as you wish, some are more energy efficient than others. Why? Because an energy efficient window treatment traps air between itself and the window. It is this trapped air that creates an insulating effect. To trap this insulating air the treatment must form a tight seal all the way around the window.

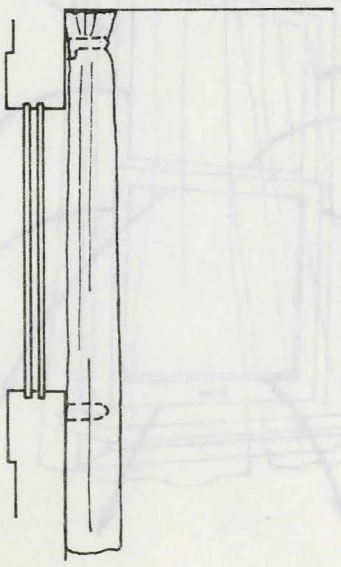
A tight seal and trapping of dead air are the two key principles in making window treatments energy efficient. It may be necessary to use multiple layers or treatments to achieve this such as drapery used with a roller shade or shutter). Also, energy efficient treatments will be used and enjoyed more if they are flexible and easily used throughout the year, rather than just in the cold winter months.

Draperies

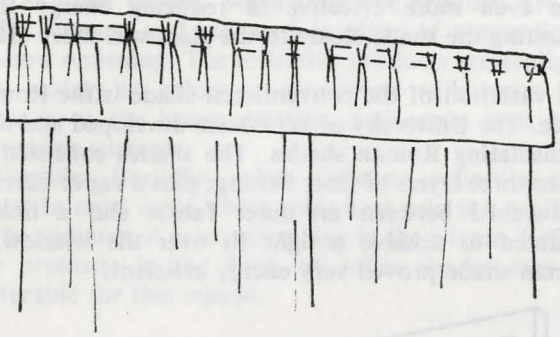
One of the most common window treatments used today is the pinch or French-pleated drapery hung on a "decorator" rod. However, with this type of hardware, the drapery is usually hung too far from the window, may not overlap at the center, and does not wrap around the rod at the side to meet the wall. Draperies hung in this way leave a large air space of little insulative value.

Install draperies so that conditioned air blows on the room side of the drapery and not between the drapery and the window. To be even more energy efficient you need a tight seal all the way around the window. Various techniques can be used. At the top of the drapery:

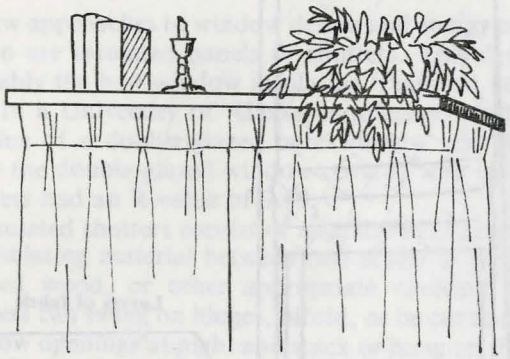
— Install a ceiling mounted drapery rod and have drapery fabric touch the ceiling.



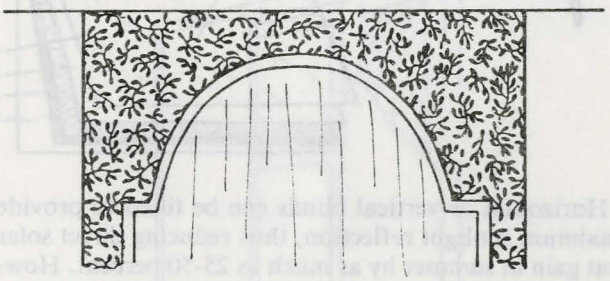
— Attach a flat board over the window treatment then cover it with a valance.



— Install a shelf over the top of the drapery.

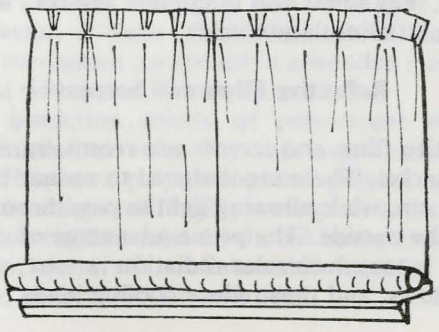


—Use a finished frame (called a lambrequin) around the window.

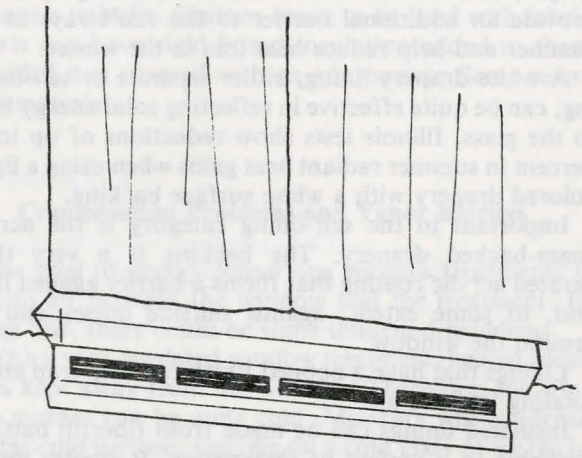


Magnetic or velcro tape can be used to seal drapery edges at the sides and center.

To block drafts from the bottom of the drapery or curtain, use a "draft dodger", a sand-filled tube of fabric placed against the bottom edge of the closed draperies if they are floor or sill length.



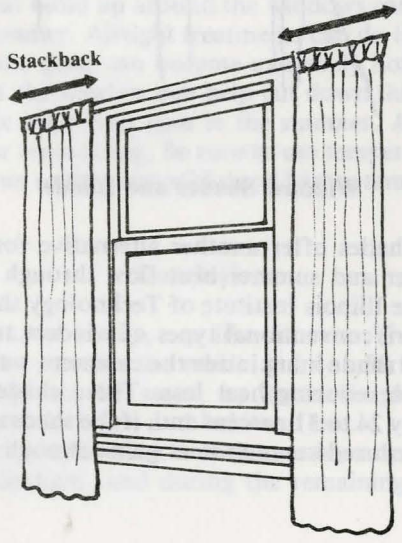
If the bottom of the drapery hangs close to a heat register, use deflectors to direct heat into the room rather than behind the drapery. If registers are on the wall or at the baseboard, do not hang draperies over them, but keep them at apron or sill length.



A Georgia research study shows that draperies sealed all the way around the window, plus at the center overlap, and hung on a double-glazed window reduced window heat loss by as much as 21 percent compared to the same window with opened draperies.

Two layers of drapery or a combination of drapery and shade or shutter further improve the thermal performance of window treatments. Again, these need to be closed off at the top, sealed at sides and reach the floor or window sill.

On sunny winter days, open draperies to take advantage of the sun's warming capabilities. To allow maximum sunlight entry, draperies should stack clear of the window opening. To allow for this you must know the amount of space the draperies occupy when open *before* you can buy traverse rods and draperies of the proper size. As a guide allow an additional 1/3 the width of the window plus .12 inches for light or medium weight fabrics.



Drapery Fabrics and Linings

In choosing drapery fabric, tightly woven, fairly heavy or bulky fabric through which air cannot readily pass provides the best choice for energy conservation.

Drapery linings are important. As well as inhibiting drapery fabric deterioration caused by sunlight, linings provide an additional barrier to the sun's rays in the summer and help reduce heat loss in the winter.

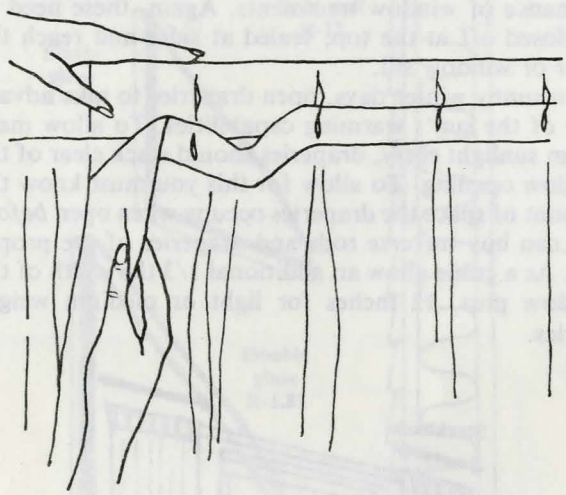
A white drapery lining, either separate or self-backing, can be quite effective in reflecting solar energy back to the glass. Illinois tests show reductions of up to 33 percent in summer radiant heat gains when using a light-colored drapery with a white surface backing.

Important in the self-lining category is the acrylic foam-backed drapery. The backing is a very thin, aerated acrylic coating that forms a barrier against light and, to some extent, against outside noises and air around the window.

Linings that have a napped finish can help trap an insulating layer of air.

Insulated linings can be made from fiberfill batting, available in a variety of thicknesses. It creates an insulating space of dead air. Because of the bulk it creates, these insulated liners are best hung on separate rods.

Purchased curtain liners or those you make yourself can often be attached to the curtain with pressure tape fasteners or some other adhesive material. Some have buttonholes at the top that can be slipped over the drapery hooks.

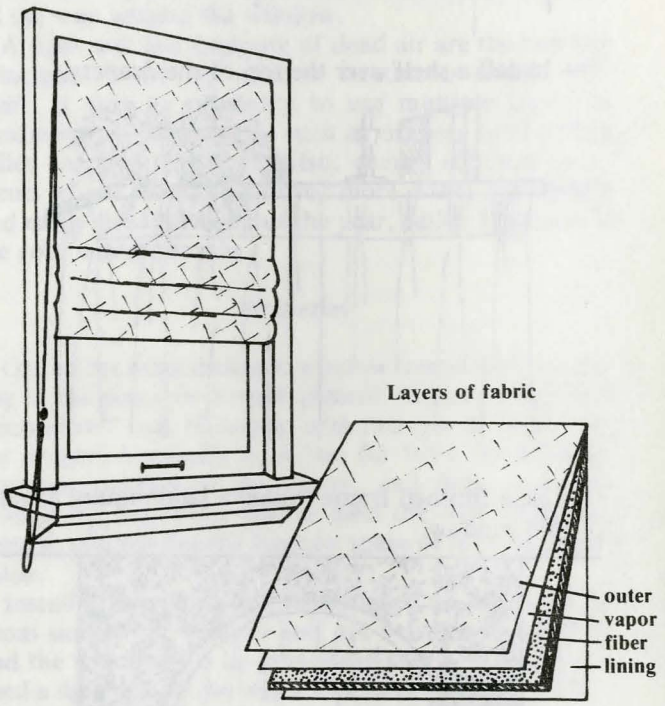


Window Shades and Blinds

Roller shades offer another alternative for reducing both winter and summer heat flow through windows. Tests at the Illinois Institute of Technology showed that of the more conventional types of window treatments, an opaque shade hung inside the casement was the most effective in reducing heat loss. These shades reduced heat loss by 24 to 31 percent and, if the shades were light colored, reduced summer heat gain as much as 50 percent.

A Cornell University study showed that shades mounted inside the window frame and sealed tightly, were even more effective in reducing energy loss. Mounting the shade closer to the glass was more effective.

A variation of the conventional shade is the Roman shade. The University of Wisconsin developed and tested insulating Roman shades. The shades consisted of one to three layers of fiber batting, plus a vapor barrier, sandwiched between an outer fabric and a lining. Mounted to achieve a tight fit over the window, a Roman shade proved very energy efficient.



Horizontal or vertical blinds can be tilted to provide maximum sunlight reflection, thus reducing direct solar heat gain in summer by as much as 25-50 percent. However, due to their slatted construction, they do little to reduce heat loss in the winter.

Their insulative value could be improved slightly depending on the type of material used and how tightly the slats fit when closed. Wood, or blinds that have one fabric-covered side, may be a better insulator.

Roll-up shades of open-weave plastic, vinyl, reed, or bamboo are excellent for filtering direct sunlight. However, they admit heat in summer and cold in winter, and have little insulation value.

Reflective Films and Screens

Reflective films and screens are recent entries in the energy market. These are designed to reduce heat gain from the sun, while allowing light to pass through and a view to the outside. The prime advantage of reflective products is to reduce solar radiation in west, south, or east windows, and thus reduce cooling loads.

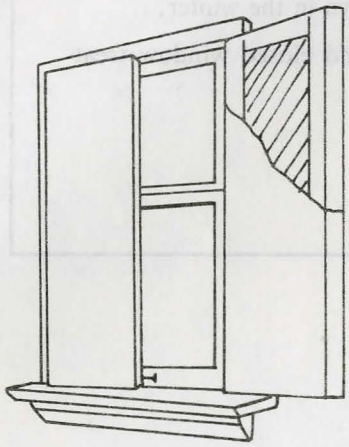
Reflective films are available in several forms. Some are applied directly to window glass. Others are available as roller shades. Some reflective products are actually screens, and are used in place of conventional window screening. The reflective products are available in a variety of colors to coordinate with room furnishings or the house exterior, and some even have decorative surfaces.

Consider flexibility when selecting reflective products. In most cases where solar heat gain is a problem in the summer, it is an advantage in the winter. Reflective products in the form of roller shades may be preferable for this reason.

Insulated Shutters

New approaches to window design and energy conservation are insulated panels or shutters. This design is probably the best window insulating treatment you can use. In a University of Alaska comparison study, the R-value of a double-glazed bare window was R-1.81, while the double-glazed window covered with insulated shutters had an R-value of 9.59.

Insulated shutters consist of a sandwich of some type of insulating material between two sheets of plywood, pressed wood, or other appropriate covering. These shutters can swing on hinges, bifold, or be cut to fit into window openings at night and stack or hang on the wall by day.



A variety of insulating materials can be used for the shutter. Rigid board insulation can be covered with decorator fabric. Polyester or fiberglass batting, mineral wool, or loose fill cellulose can be sandwiched between corrugated cardboard in a wooden frame, then decorated with paint, fabric, or posters.

Rigid insulation panels of polystyrene offer the highest insulation value for the least thickness and weight. However, polystyrene and polyurethanes are flammable and give off highly toxic gases in the event of a fire. Flammable insulation should be sandwiched between two layers of nonflammable material such as masonite, each 1/2" (2.5 cm) thick.

Insulated shutters properly constructed can be one of the best insulating treatments. They must fit tightly. Materials used will determine the ultimate insulating value of this treatment.

Standard interior wood shutters do not have a high insulation value, mainly because the louvers and the place where the two shutters meet make it difficult to achieve a tight fit. Shutters made to be used with fabric inserts can have rigid board insulation added to them provided it is covered with an appropriate flame retardant material.

Condensation Problems and Vapor Barriers

The goal of energy conserving window treatments is to trap air between the window and the treatment. In doing this, there could be some uninvited problems.

With a well-insulated window treatment, heated room air is kept away from the window. Therefore, the window surface can be quite cold. Moisture will condense on this cold surface, just like on a cold glass of ice tea in the summer. This moisture condensation could cause problems of mildew and deterioration of the window frame.

It is important, therefore, to have a tight fit and incorporate a vapor barrier into any energy efficient window treatment. The vapor barrier can prevent moisture in the warm room air from reaching the cold window, thus, stopping condensation. It is a simple, inexpensive step that can avoid many future problems.

A layer of 4 mil plastic just under the outer layer of the treatment (the side closest to the warm side of the room) will provide an adequate vapor barrier. This is a good choice for Roman shades, insulated shutters and panels.

Aluminized mylar is a good alternative for a roller shade or a drapery lining because it not only serves as a vapor barrier, but it can reflect heat back into the room as well. This choice is considerably more expensvie than plastic.

While condensation problems can plague you in winter, heat build up around the windows can be a problem in summer. Airtight treatments can do their job so well that the glass can become extremely hot. Exterior shading of the window can help cut down this problem and reduce solar heat gain in the summer. Also, when building or remodeling, be sure to use tempered glass in the windows so they can withstand higher temperatures.

Conclusion

Windows, in a way, are like faucets. They can be regulated to provide the needs and comforts desired. And energy can be saved by some simple window management decisions and habits of use.

During the cold winter months, we have only about 8 hours of daylight, and during the remaining 16 hours

windows do not perform their intended function of providing light. Rather they are an enormous heat drain on the house.

So, take a good look at your windows and interior window treatments. Manage your window systems to get the most of your home energy dollar.

† † †

Key Points in Window Management

—While windows represent only 15-20 percent of the average home's total floor area, they may contribute 20-50 percent of the home's heating load.

—The more layers of glass in a window, the greater the reduction in heat loss.

—An energy conserving window treatment must trap air between itself and the window.

An energy efficient window treatment forms a tight seal all the way around the window.

—An energy efficient window should be flexible: easy to operate from open to closed position, and easily used throughout the year.

—Close window treatments as much as possible on cloudy days and open them on sunny days during the wintertime.

—Close window treatments as soon as the sun goes down in the winter.

—Use precautions against condensation build-up behind closed window treatments.