ENERGY FACTS

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Energy-Conscious Interior Design

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Energy-conscious interior design is the designing and planning of rooms and specification of materials with the goal of reducing energy consumption in a home. Energy-conscious occupants focus on ways to make their homes thermally comfortable while reducing energy consumption. Interior design affects both comfort and the ability of the home to operate at its peak thermal capacity.

Energy-conscious design combines conservation methods, such as insulation and thermostat set-back, with passive solar heating. This design approach can be applied to both newly built homes and older homes. It involves first making the home as energy conserving as possible, then supplying the remaining heating needs with solar heat by increasing the number of windows on the south side to collect heat (and possibly reducing the number of windows on the north and west sides), using thermal mass to store heat, and properly designing and placing walls and furnishings to allow distribution of heat.

For passive solar heating to be effective, interior treatments must not interfere with the collection, storage and distribution of heat. Of course, this creates some problems for the interior. Heat collection often means that sunlight will shine directly on interior materials. This can cause glare, overheating, and fading and deterioration of materials. Storage of solar heat occurs in a dense mass material such as concrete, brick or water. Most mass materials are hard surfaces that reflect sound. Combining the hard thermal mass with a large expanse of window glass gives you many sound-reflecting surfaces. Therefore, if not absorbed by proper materials, noise can become a problem.

Heat distribution can be hampered by misplaced furniture or decorative treatments. Furniture design should enhance air circulation, and furniture placement should allow maximum exposure of the thermal mass to the sun. Therefore, you need to pay special attention to the selection of colors, textures, finishes, fabrics and materials, and to the design and placement of furniture so you can minimize the problems associated with increased south-facing windows and maximize thermal performance. The following information will help you make appropriate selections or modifications.

Color

The element of color is one of the most influential in the interior environment. Color affects people and the environment both physically and psychologically. Color, or hue, is only one dimension of color. The others are value, or lightness and darkness; and intensity, or brightness and dullness. All three determine how you perceive a color.

The lightness or darkness of a color affects whether it can absorb or reflect heat and light. Generally, light values—tints of a hue such as beige, pink or cream—are used to reflect heat from a lightweight thermal mass, such as furniture or ceilings, to a more efficient mass that stores the heat, such as a brick wall. If the quantity of daylight is too great, however, a light value color can increase glare. The use of light values to reflect heat can be balanced by dark value colors on the thermal mass.

Light values should also be used to diffuse light throughout a room or direct light to a darker area. A medium-light value color that has good reflectance (70-90 percent) can be a better selection than stark white (95 per-

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cent), which would increase glare. If the reflectance is not listed on the paint you purchase, check the manufacturer's specifications. The owner or manager of the store will have a book listing the reflectance of each premixed paint.

The color used in a room can make you feel warmer or cooler. Generally, reds, oranges and yellows are considered warm colors. These would be used where the actual room temperature is cooler, such as on the north side of the house where there is no direct sunlight. The cool greens, blues and violets should be used in rooms with southern or even western exposure. During the daytime or late afternoon, the temperature rises in rooms with south- or west-facing windows. Cooler hues can provide a psychological coolness you can enjoy along with the physical warmth of the room.

Glare

Have you ever walked into a sunlit room, only to suffer discomfort due to the brightness of the light? Have you tried to read a newspaper or perform another task in the sunlight but couldn't because of the glare on the paper? Glare is one of the possible effects of increasing the areas of south-facing windows. Southern daylight provides physical warmth but can cause glare that makes it difficult to perform some tasks.

Glare can be reduced at the window by filtering the light with plants. The plants absorb some of the light and reduce the intensity by casting small shadows. Of course, they also reduce heat gain. Louvered blinds might be a better solution, though more costly. The popular 1-inch mini-blind now comes in numerous colors and ready-made sizes. The horizontal louver can be slanted to direct light away from a task surface. The light then gets bounced off the ceiling, diffused and bounced into darker areas. Another advantage of the mini-blind is its utility on vertical or sloped windows, as well as skylights. Of course, the mini-blind is made of a material that has no thermal quality and will not insulate a window.

You can also reduce glare by selecting materials with colors, textures and finishes that absorb light. Although light absorption and reflection are based on color, texture and finish are also important. Generally, soft textures and matte or dull finishes absorb light, helping to reduce glare. For example, a soft-textured, light-colored material, such as a beige shag rug, would absorb some light because of the texture and reflect some light because of the color. The overall effect would be a softening of the light, plus some sound absorption. This could be appropriate in a southern room. Hard textures and glossy or shiny finishes, on the other hand, reflect light. For instance, a shiny, hard surface, such as chrome or foil wallpaper (which would reflect about 90 percent of the light striking it) could be effective in a north room where little daylight is seen, but it should not be used in direct sunlight.

Deterioration of Materials

Direct and indirect sunlight causes considerable damage to textiles and other interior materials. Extension bulletin E-1772, "Fabrics for the Energy-Conscious Home," covers sunlight deterioration of upholstery, window and carpeting textiles. Other interior materials can also be damaged by sunlight. Generally, most interior materials, such as paints and wallpapers, will fade or otherwise discolor. To equalize sunlight damage, periodically move furniture to other locations in the room. Accessories, especially oil paintings, will also deteriorate in the sun. Any print under glass hung in direct sun may be damaged by moisture that condenses under the glass.

Woods used in floors, walls or furniture not only change color in sunlight but also dry out from the heat. This can cause cracking, splitting and loosening of joints. Proper care of wood products provides some protection. Keep wood furniture out of direct sunlight. Use furniture oil or wax to help seal the wood, but avoid products containing alcohol—it will accelerate the drying of woods. Solid woods are more likely than veneers to shrink or swell because solid wood is less flexible. Generally, woods will lighten when exposed to daylight, though some very light woods will darken. The majority of change in wood color occurs in the first year. Though some change continues, the effect will tend to stabilize after one year.

Some stains actually accelerate the color change. That is, a natural wood will change color at one rate, but a stained piece of the same wood will change faster because a different chemical process occurs and the stain pigment changes, not the wood pigment.

Thermal Mass

The thermal mass added to a house enables the solar heating system to work properly. Mass, in the form of a dense material, absorbs heat during the daytime to prevent overheating. It then stores the heat until the air temperature of the room drops when the sun goes down. Then the heat is naturally released from the mass material, warming the interior throughout the cool night. For a familiar example of this process, think of a blacktop road in the summer. The surface of the road gets so hot that you can't comfortably walk on it

barefoot. As the sun goes down, the heat stored in the mass of the road is released to the air, cooling the road surface. This same natural process occurs in the passive solar home, except that the heat is trapped by the walls or floors of the house and used to warm its occupants. (Insulation is closed across the windows at night to keep the heat inside.)

Using inappropriate materials for the thermal mass can hinder this process. A mass material's effectiveness is measured by its ability to absorb sunlight, conduct surface heat into its mass and hold the resulting heat. Mass materials vary greatly in the amount of heat they retain. Frequently, older structures are not designed to support the weight of additional thermal mass. Lightweight, efficient mass is suggested for many installations. Additional information on this, as well as the heat retaining ability of materials, can be found in ASHRAE (see references). Following is a table showing the percentage of heat retained by various mass materials.

TABLE 1: ABSORPTION OF HEAT.

Material	*Percent Heat Retained*
Brick, glazed white	26
Brick, common red	68
Marble, white	44
Marble, dark	66
Granite, reddish	55
Slate, blue/gray	87
Slate, dark gray, rough	90
Concrete	65
Steel, enamel red	81

As you can see, the percentage absorption varies according to material, color, and finish or texture. Table 1 suggests that the best thermal mass materials would seem to have a dark-colored, rough, matte surface. Many of the above materials are prefinished or can have a color or finish added. For example, a poured concrete floor can be patterned and colored to look like brick or slate.

Of equal importance is the need to place furniture so that it shades the mass floor or wall as **little** as possible. The general rule of thumb is to shade less than 30 percent. This will still allow maximum effectiveness for heat absorption and release. The furniture also should be raised off the floor slightly so air can circulate. This means no wall-to-wall carpeting; no large sectional sofa; no skirted sofas that shade mass floors; no bookcases on mass walls; and no secretaries or armoires on mass walls.

Conclusion

Consider all the preceding information in light of your lifestyle, preferences and budget. Fine tuning your energy-conscious interior design will take some effort, but it will allow you to reduce energy consumption without losing design quality.

Here is a list of additional energy conservation measures that are possible through appropriate interior design:

1. Covering walls with fabric, gathered on a rod top and bottom (be sure to flame-proof the fabric).

2. Using closets as buffers on north or west walls.

3. Adding a heat lamp to a bathroom to take the chill off on cold mornings.

4. Using thermal wallpaper to insulate, foil wallpaper to reflect heat back into the interior.

5. Using filled bookcases on outside, non-mass walls to act as insulation.

6. Using large decorative area rugs, tapestries or fabric wall hangings on outside, non-mass walls to add insulation.

7. Using carpet and a good pad to reduce heat transfer through floors, in addition to keeping bare feet warm.

8. Using high-back, overstuffed furniture in northern rooms to reduce drafts and allow one to become engulfed (snuggle) in the chair.

9. Using furniture with skirts where drafts need to be avoided.

10. Using a reversible ceiling fan to pull the air up in the winter to circulate the warm ceiling-level air without any draft on the occupant (particularly those fans placed directly over a seating area). Then reverse it for summer so the air flows across an occupant, cooling by evaporation.

Here is a list of products and where to find them to help conserve energy:

1. **Movable insulation:** designed to cover and insulate windows on the interior; can be found at fabric stores, energy stores, drapery shops and some lumber yards.

2. **Mini-blinds:** used to reflect sunlight and focus daylight; can be found in most department or drapery stores.

3. **Insulated decorative ceiling tiles:** added to the ceilings as insulation; can be found in lumber yards and energy stores.

4. **Thermal wallpaper:** used to add insulation to outside walls; can be found in energy stores, lumber yards and some wallpaper stores.

5. Vinyl wallpaper: used as a vapor barrier on outside walls; found in wallpaper stores.

6. Patterned and dyed concrete floors: used as a thermal mass, cheaper than tile floor and aesthetically pleasing; inquire of local contractors.

7. Area rugs: used on north walls to insulate, in buffer areas to insulate or add psychological warmth; can be found in department and carpet stores.

8. Quarry tile, ceramic tile, brick veneer or paving brick: used as a decorative treatment and additional mass over the thermal mass floor or wall; can be found at building supply firms and some lumber yards.

9. Fluorescent lighting fixtures: used to replace some incandescent fixtures, especially in bathrooms, kitchens and utility rooms; can be found in electrical and lighting supply stores.

9. Other energy-conscious design products can be found in energy stores or order the *Solar Age Resource Book*, Everest House, 1133 Avenue of the Americas, New York, NY 10019.

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