Saving Energy in Existing Houses

There are substantial opportunities for reducing heating and cooling costs in many homes. Energy losses occur in two general ways. Air and heat leaks through cracks or holes in walls, ceilings, and floors, and around doors and windows. Or heat is conducted through doors, windows, ceilings, walls, or foundations. In order of priority, steps that can be taken to reduce heat loss are to:

- caulk, weatherstrip, and glaze
- improve windows and doors
- control moisture problems
- insulate ceilings
- insulate exterior walls
- insulate basement walls, crawl spaces, or slab foundations

**Weatherstrip, Caulk, and Glaze**

The major purpose of weatherstripping, caulking, and glazing is to fill cracks or voids to “tighten-up” the house. Weatherstrip all windows and doors so they seal tightly when they are closed. A variety of metal, plastic, felt, and foam weatherstrip materials is commercially available (figure 1). The cost and durability of these vary, and some are more appropriate for certain applications than others. But their essential function is simply to plug cracks or holes and reduce air infiltration.

Caulk around exterior trim surrounding window and door openings and exterior siding joints. Check for cracks on top of the foundation below the siding. Caulk around any wires, pipes, or vents that come from inside the house.

Several types of caulking compounds are available—oil-base, latex, butyl, and silicon being most common. Urethane-type foams in pressure cans also are available. The most common application procedure involves using caulk in tubes applied with a caulking gun (figure 2).

Carefully maintain glazing or putty around glass panels in windows and exterior doors. Deteriorated glazing allows infiltration of air and water.

**Improve Windows and Exterior Doors**

Substantial heat loss can occur through windows and doors. Windows, particularly, are very poor insulators. The proportion of total heat loss through windows depends on the number, location, and size of windows in a house. Adding storm windows and doors, with a dead air space between the layers, can cut heat loss in half (figure 3). A third layer of glass or plastic installed on the inside or outside, creates a second dead air space, and can reduce the loss even more.

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**Figure 1. Many weatherstrip materials are available.**

**Figure 2. Caulk often is applied with a caulking gun.**

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Iowa State University Extension pamphlet Pm-882, *Minimizing Moisture Problems in New Houses*, provides additional information.

Do not try to hold relative humidity levels too high during the winter. A level of 30 percent should provide adequate comfort, unless occupants have special health problems that are alleviated by higher levels. Reduce humidity levels in very cold weather. Excessive condensation on the interior surfaces of window glass signals a need to reduce humidity.

Also, make sure unheated attics have adequate ventilation. Attic venting helps remove excess water vapor during winter and reduces excessive heat build-up in the summer. In most houses, vents should be provided both at the lower edge of the roof (overhang) and at or near the peak (figure 4). Provide at least 1 square foot of free vent opening for each 150 square feet of attic floor area. Divide the total required area of vent opening between the top and bottom of the roof. Make sure the flow of air through vents is not restricted. Check your attic during the heating season. If frost or ice appears on the underside of the roof sheathing, you probably need more ventilation (figure 5).

Guard against moisture problems in exterior walls. Water vapor will move from the interior of heated houses into wall cavities and unheated attic spaces. Adequate venting may solve the problem in attics, but a barrier to retard the flow of water vapor may be needed on or near the interior surface of exterior walls (figure 6). Iowa State University Extension pamphlet Pm-947, *Controlling Winter Moisture Problems in Houses*, provides detailed information on controlling moisture.

**Insulate Ceilings**

Check the depth of any existing insulation and determine the associated R-value (the ability of a material or combination of materials to resist the flow of heat). The higher the R-value, the better the insulation. The R-values per inch for common loose-fill insulation are 3.7 for cellulose fiber, 3.0 for mineral wood, and 2.5 for glass fiber. Batt or blanket insulation has labeled R-values for several standard thicknesses.

Insulation usually can be added easily above the ceiling separating the living area from unheated attic (figure 7). Add sufficient insulation to make a total R-value of at least 38. An R-value as high as 60 may be appropriate in some situations and is likely to be a good investment as energy costs increase. The depth of insulation will vary depending on the type selected.

Loose-fill insulation may be poured by hand or blown in with a special machine. Make sure insulation purchased for blowing is appropriate for use with the machine. If blanket insulation is used, install the vapor barrier down (toward the heated area) or install the type that does not have a vapor barrier attached. After the space between the joists is full, place additional layers of unfaced (without a

Correctly installed, tightly-fitted shades, drapes, or quilts also can reduce heat loss in the winter and heat gain in the summer. To reduce heat loss further, install tightly-fitted, insulating panels over north, west, and east windows. Install such panels on either the inside or outside.

**Control Moisture Problems**

As houses are tightened up and before insulating, give attention to minimizing moisture difficulties and potential damage. Excessive penetration and absorption of water by various building materials can lead to a variety of problems.
vapor barrier) insulation perpendicular to the framing members. Make sure the insulation does not cover attic vents. Do not place insulation over light fixtures recessed into the attic because it could create fire hazards.

**Insulate Exterior Walls**

Insulate exterior walls in older houses to reduce heat loss. Empty wall cavities may be filled with loose-fill insulation using a machine to blow in the material. The cavities between all vertical wall framing members should be filled with insulation. A strip of exterior siding can be removed at the top and bottom of each story and holes drilled through the sheathing (figure 8). Or holes can be drilled through both siding and sheathing, and then plugged after insulation is installed. Drill additional holes below windows to fill those spaces. Many homeowners may elect to have this job done by professionals.

In homes with brick veneer or stucco siding, you may need to drill holes between framing members on the inside surface of exterior walls. An R-value of 13 to 15 usually results from completely filling the exterior wall cavities.

**Insulate Basements, Crawl Spaces, Slabs**

The final step in energy improvement is to insulate basements or other types of foundations. Basements must be dry before insulating. Solve any moisture problems before you proceed. Basement walls may be insulated either on the inside or on the outside. Since insulating on the outside would require excavation along the entire foundation, insulating on the inside may be the most reasonable choice.

The preferred method for insulating the interior of basement walls is to construct a wood-frame wall directly in front of the existing masonry structure and fill the space between framing members with blanket or batt insulation (figure 9). Another technique that can be used is to install furring strips on the masonry wall and insulate between the strips with plastic foam insulation. The finish covering would usually be either gypsum wallboard or
Houses with crawl space foundations may be insulated in two ways. If the crawl space does not have any water pipes or heating ducts, insulate the floor above the crawl space (figure 10). If pipes or ducts are present, the wall around the crawl space should be insulated on the inside (figure 11) or on the outside. An R-value of 13 or 14 is appropriate for perimeter walls. An R-19 batt may be installed between floor joists.

Install a ground cover, such as polyethylene plastic, on the floor of the crawl space to minimize moisture migration from the soil to wood members. Crawl spaces without water pipes or heating ducts should be vented in winter and summer. Where pipes or ducts are present, vent only in the summer.

In houses on concrete slab floors, install perimeter insulation. Dig a trench immediately adjacent to the exterior foundation wall, install water-proof rigid panel insulation (extruded polystyrene or urethane types), cover with a decay resistant material (treated plywood), install metal flashing over this assembly and refill with soil (figure 12). Choose a type and thickness of rigid insulation that will provide an R-value of at least 8.

Other Energy-saving Ideas

Window area and placement in a house have major effects on energy conservation. Owners of older houses may wish to consider reducing window area on the north, east, and west and increasing window area on the south during remodeling.

Shading windows with roof overhangs or awnings can offer real protection from unwanted summer sun. For example, an overhang of 24 inches or more over most south windows can minimize penetration of summer sun while allowing the winter sun to enter.

Evergreen trees planted on the north and west sides of the house can reduce the chilling effects of winter winds and cut fuel costs. Deciduous trees on the south and west can reduce home cooling bills by providing shade from the hot summer sun.

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