UNIVERSITY OF FLORIDA
Florida Cooperative Extension Service

Fact Sheet EES-35
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Building and Remodeling to Save Energy[1]

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Home energy conservation measures that save money on utility bills are particularly important in Florida. Utility costs are predicted to grow much faster than the inflation rate because our increasing population is widening the demand for new electric and gas hookups.

Some conservation measures are as simple as turning off lights, keeping doors shut, and turning thermostats up in summer and down in winter. Energy use can be reduced by selecting from a variety of design, construction, and remodeling strategies. Some of these may require an additional investment of money, but not always. A good investment will provide a large utility savings at low initial cost.

Homeowners should also consider appearance, potential for resale, and comfort or security when contemplating cost-saving measures. For example, insulated or double paned windows give a relatively poor payback in energy savings compared to investment. They may, however, reduce outside noise levels. Exterior shutters save energy and may also provide security and comfort. Properly designed fireplaces provide heat and aesthetic accent to a home.

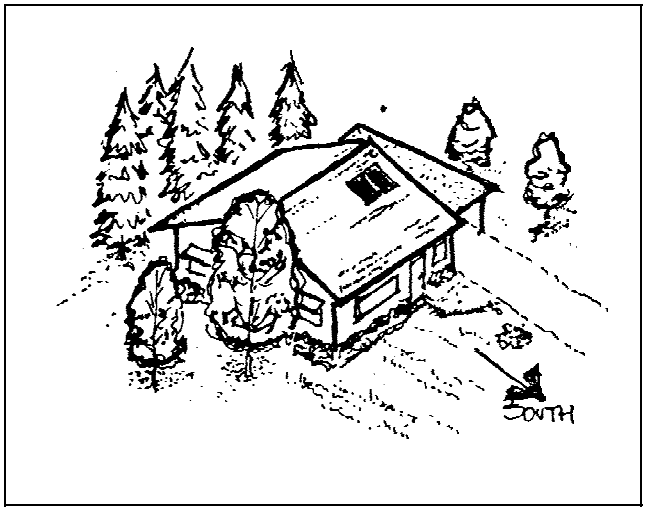

Figure 1. Landscaping can save energy required to cool or heat a home.

HEAT TRANSFER

An understanding of how heat is transferred into or out of a home will aid you in selecting energy conservation measures. Briefly, heat is transferred by conduction, convection, or radiation. Heat is transferred by conduction through direct physical contact of a warmer surface with a colder surface (heat travels from a frying pan to its handle). Conductive heat transfer can

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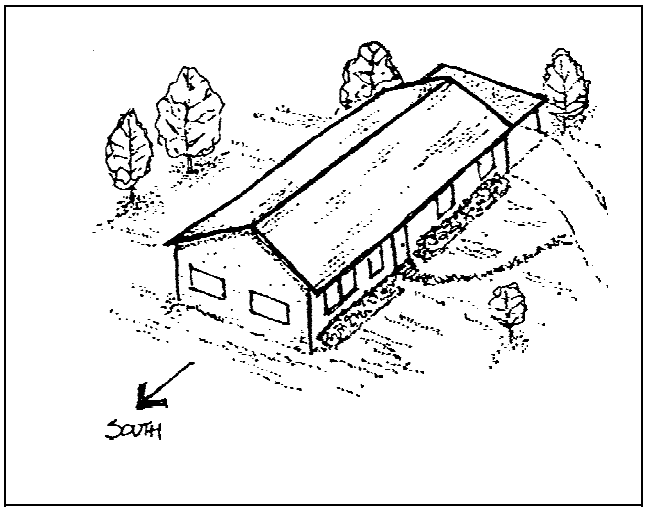

Figure 2. An energy inefficient home.

be reduced by insulation such as batts, fill, or foam plastics.

Transference by convection is a combination of mass and heat transfer (a candle heats up the air above it; the warm air rises and is replaced by colder air). Convective heat loss is reduced by making the home tight through sealing, weatherstripping, caulking, and proper design.

Radiation heat transfer occurs by electromagnetic wave force when one surface is hotter than another. These surfaces do not have to be in contact. This is the only heat that can travel through a vacuum (the sun's heat is entirely from radiation). The best way to control radiation is by shading and using reflective radiant barriers.

Our feelings of warmth or coldness are influenced by the surface temperature of objects around us, air circulation, and humidity. We feel cold when objects around us are cold, when air is blowing around us (wind chill factor), and when the humidity is low. We feel hot when surfaces around us are hot, when air circulation is poor, and when humidity is high. Remembering the ways heat is transferred and with consideration for comfort and cost efficiency, homeowners can look at several energy-saving options when buying or remodeling.

HOME DESIGN

The geometric design of a house will influence both its cost and its energy efficiency. A house with a length-to-width ratio of one-to-one (square) will have 25

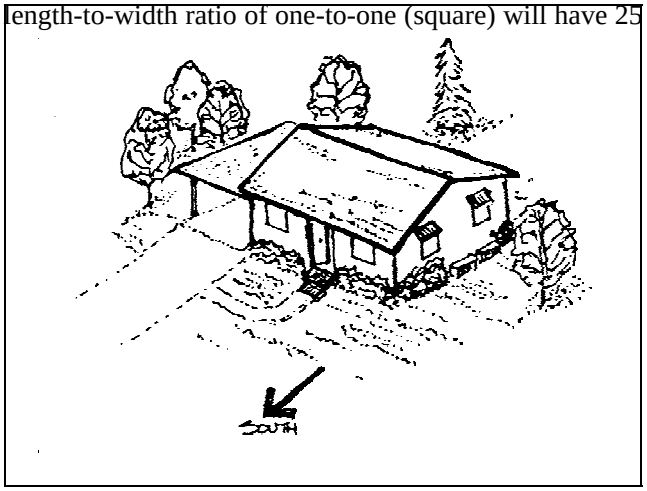

Figure 3. An energy efficient home.

percent less material in its exterior walls than a comparable house having a four-to-one ratio long rectangle). Reducing wall area usually translates into reduced energy losses. See Figures 2 and 3. Although a pleasant feature, an open courtyard increases surface area and, therefore, energy losses.

Some builders believe that a house with a length-to--width ratio of 1.7:1 is best for the hot, humid climate of Florida. This is true only if the long side faces north or south and if the house has adequate overhangs. Placing the garage, workshops, porches, bathrooms, and closets on the east and west side of the house will reduce radiation gain from the sun by acting as a buffer.

Because of our abundant sunshine, landscaping is one of the most attractive energy conservation measures. Trees on the east and west sides of a home provide shade and protection from the sun. In addition, shrubbery can be placed to capture the natural breezes. County extension agents can provide details on what types of trees or shrubbery to plant.

In a typical home, more energy is lost through glass doors or windows than through any other construction element. This is particularly true in Florida. The direction in which windows face will greatly influence the energy required for heating and cooling. Properly designed overhangs (about 21/2 feet) can almost entirely eliminate direct solar radiation through south-facing glass in the summer, but will allow heat to enter in the winter. West-facing and east-facing windows and glass doors

should be kept to a minimum. This is because the sun's direct radiation is difficult to control in the summer and, therefore, overhangs must be excessively long (and expensive) to be effective.

Replacing windows with thermal double paned types is not a cost-effective option as mentioned before, but shading of the east and west windows will save energy. Use of curtains is not as attractive an option as exterior shading. The best exterior shading devices are landscaping, Bahama or Bermuda shutters, solar screen, overhangs, and awnings. Window **film** is an option particularly if placed on the outside of the glass. If film is placed on the inside, the glass tends to heat up.

Particular attention should be given to the shading coefficient of the device or screen being considered. A shading coefficient of 0.5 means that 50 percent of the sun's radiant energy is filtered. Some shading devices have shading coefficients as low as 0. 13; they will effectively screen out 87 percent of the sun's radiant energy.

On a hot summer day, more energy will come through just one square foot of clear glass than through an entire insulated wall. Over 90 percent of that energy is in the form of radiant energy. Thermal paned windows have very little effect on radiant energy unless the glass is tinted or somehow shaded.

Windows should also be oriented horizontally to provide maximum viewing benefit. Horizontal, compared to vertical, windows provide more ventilation because of the way the pressure builds up on the side of the building. Windows should be designed to open, so that on moderate days the home is opened to breezes.

Adding insulation can be cost effective, especially in the attic. If the attic has batt insulation, there is no problem with blowing insulation such as cellulose on top of it. It doesn't matter if the insulation is of the same type: fiberglass may be added to cellulose or vice versa. It is suggested that batt insulation not be placed over blo'Am insulation, but the reverse operation is possible.

According to recent research, one of the best energy saving options in an attic is the addition of a radiant heat barrier. Foil-backed paper is placed on top of the existing insulation or stapled to the rafters or trusses so that there is an air space either above it or below the reflective surface. At least a 1/4-inch air space next to the reflective surface provides the barrier effect. The reflective side does not have to face the heat source to be fully effective. This is a relatively low cost measure with a big energy payback.

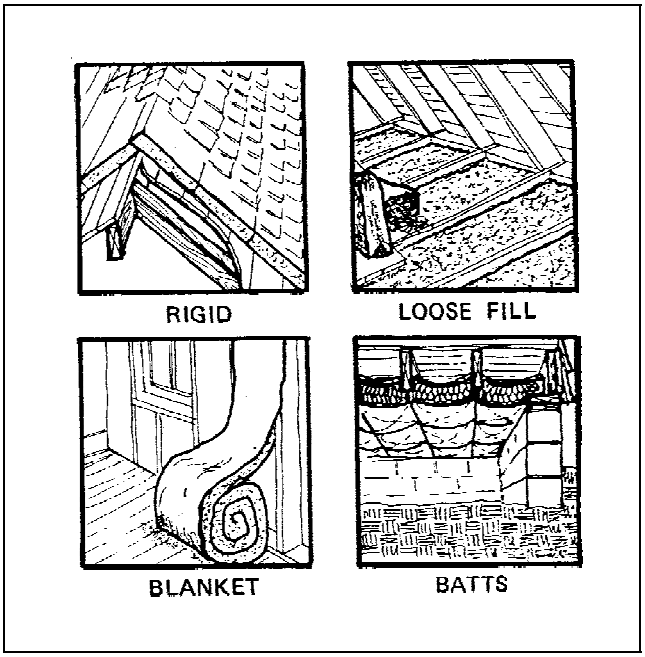

Figure 4. Types of Insulation.

Proper installation is very important to achieve the R-value or level of insulation you are paying for. For example, if there are gaps in the insulation next to the studs where the wires go from the wall to the attic outlet, insulation performance is lower. Compressing the insulation will also degrade its performance. A 3 percent gap in the insulation will degrade performance by 20 percent. Compression will degrade performance in a nearly one-to-one ratio. If insulation is compressed by half, the performance is reduced by a little more than half.

Typically, 20 percent of energy that is lost through infiltration enters the attic by ways of gaps in insulation near wires in the wall and through electrical outlet switch covers. Placing foam inserts over switch covers is an effective way to stop this air infiltration. Foam outlet covers should be added to outlets on both the inside and outside walls to be fully effective. Childproof covers should be inserted over the outlets not used and can be purchased at many discount stores and building supply houses.

AIR CONDITIONERS AND FURNACES

Replacement of an air conditioner more than 10 or 12 years old or of very low efficiency may be an option, especially with many utility companies offering cash rebates for installation of more efficient models. The

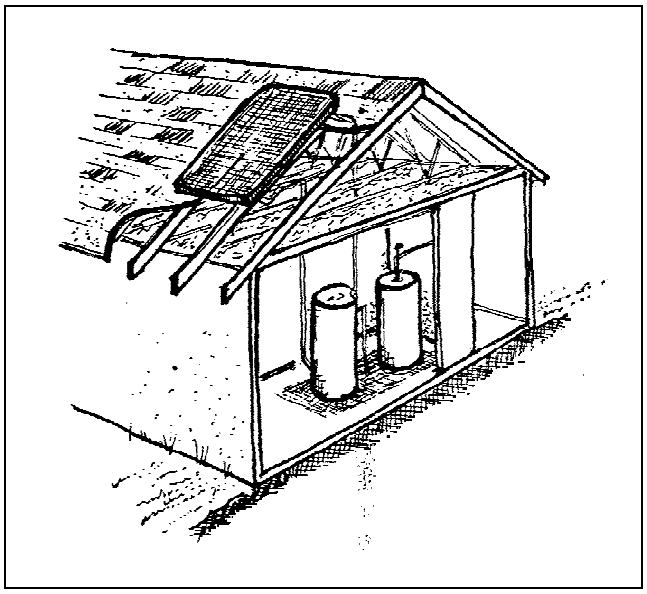

Figure 5. Solar Water Heating can be an Energy-Efficient Construction Option.

combination of rebate and the energy savings may more than offset the price tag. An air- conditioning contractor can explain efficiencies of new models. The seasonal energy efficiency ratio is an indicator of its efficiency. The higher the number the better. However, if the model has an efficiency ratio of over 10, have the air conditioning contractor verify that their model will be able to remove enough inside moisture to keep humidity levels tolerable.

Replacement of oil and electric heating systems with an efficient heat pump or natural gas furnace might be a very cost-effective decision. By using either an efficient heat pump or natural gas system, heating costs may be reduced to one-third the cost of heating with electric strip heat. A heat pump is designed to cool in the summer and provide heat in the winter. The heating side efficiency is rated by coefficient of performance (COP). The higher the COP the more efficient the heating side. A unit with a COP of 2.5 will provide 21/2 times more heat as an electric strip heater using the same energy. Before replacing an electric furnace with either gas or an electric heat pump, ask your utility company if it offers rebate or incentive programs.

SAVINGS WITH FANS

Fans can save energy dollars. A ceiling fan can be used with or without air conditioning. With the windows open during moderate outside temperatures, a fan can be used without air conditioning to provide a wind chill effect. With air movement, temperatures as high as 84 or 85 degrees are tolerable without air conditioning. When used with the air conditioner, the thermostat may be set between 82 and 85 degrees to provide the same comfort as a thermostat set at 78 degrees with no fan. Many ceiling fans can be reversed in the winter heating season to circulate warm air that collects near the ceiling.

Use of a whole house fan is another option. These can suck in great quantities of air from the outside, pushing it through the attic and providing two benefits: a wind chill effect while bringing in moderate outside air and significant attic cooling. A whole house fan can provide an additional benefit by removing indoor pollutants (cigarette smoke and cooking odors) very rapidly. Whole house fans should not be used during periods of high humidity or when airborne pollutants (dust, smoke, or pollen) are high. Attic fans and turbine vents designed to cool only the attic have not proven effective at reducing energy costs.

FIREPLACES

Many fireplaces are very inefficient. They often use more energy than they supply in terms of heating, especially if they use the inside air for combustion rather than their own outside air source. Fireplace inserts and glass covers can be purchased that improve efficiency. Wood stoves are very efficient, but they require a lot of work and they may not be as aesthetically pleasing as a fireplace.

In many homes water heating can account for up to 30 percent of the monthly energy bill. There are a number of items that are designed to heat water efficiently and reduce cost. In South Florida, heat recovery units can supply water heating for the long cooling season at low cost. Many air-conditioner manufacturers offer a package deal on air conditioning and heat recovery. Some utility companies may offer rebates for heat pump water heating and solar water heating.

With a heat pump water heater a reduction in water heating cost of up to 50 percent can be obtained, providing free air conditioning at the same time. An ideal location is the kitchen where a lot of heat is generated. Heat pump water heaters also can be placed near the existing water heater. Located in a garage or utility room, these can be mounted so that an opening takes advantage of air conditioning in the summer. It is closed in the winter when cooling is not desired.

Solar water heating may be a good choice, especially if there are tax rebates and utility incentives to reduce cost further. Prior to January 1986, a 40 percent tax credit was given for some solar purchases up to $ 10,000. These credits may be reintroduced. A solar system should be of proper size, receive sufficient direct sunlight, and be installed correctly to give it an attractive appearance. In most cases the collector can be placed flat on the roof. The simpler the system, the less is the chance that things will go wrong.

Installation of water heater timers generally is not as cost-effective as wrapping the water heater with extra insulation. If natural gas is available, replacing a worn out electric heater with the high efficiency gas heater may be an answer to utility cost savings. This savings can often equal or exceed the savings obtained by using solar water heating, heat recovery, or heat pump water heating options.

Careful selection of energy conservation measures can provide comfort and savings and may offer additional benefits such as noise reduction, security, and beauty Other publications that may be helpful are Insulation: Selection and Installation (EES 25), Energy Efficiency: a Marketing Tool (EES 24), Whole House Fans: Benefits and Description (EES 32), Whole House Fans: Installation (EES 33), and Selecting a Heat Pump (EI 8).