

# EARTH MATTERS

## **Retrofitting Your Home for Improved Energy Efficiency**

By Bob Seavey, PhD

### **Insulation and Air Sealing**

One of the first types of energy retrofits to consider would be added insulation and air sealing. Why? Insulation and caulking are among the least expensive 'building materials.' We lose heat from the ceiling, walls and foundation (basement) of our house. Added insulation slows the rate that heat is lost from the house meaning lower heating bills and less fossil fuel consumption. Adding insulation to the attic may be very beneficial. Often attics have more space to add insulation. Air sealing (from interior house to attic) and added insulation can reduce problems with ice dams. Care should be taken to keep from blocking attic ventilation passages around the soffit. You may also consider blown in insulation for your wall cavities. Older houses often have only minimal wall insulation. It is important to find a quality contractor for this work, so that wall cavities are filled completely and evenly.

Another location for air sealing and insulation would be between the floor joists at the outer wall (or rim joists). This area may be accessed from the basement. Closed cell foam insulation is well suited for this project. Foam board is cut to fill the space between the joists and then fitted into place. Caulking is used around the perimeter of the joist so that the area is air-sealed.

As a final note concerning added insulation and air sealing, it is still important that your house be able to ventilate: exchanging inside air with outside air. Indoor air quality depends on this air exchange. If we aggressively seal up our houses, we still need to consider ventilation. This may be an outdoor vent that comes into the utility room coupled with exhaust fans for the kitchen and bathrooms. Installing an air-to-air heat exchanger is more expensive, but it has the advantage of capturing some of the heat from exhausting air.

### **Programmable Thermostats**

Another alternative to reducing energy consumption in your house would be to install a programmable thermostat. With this type of thermostat, the temperature of the house can be reduced during periods when no one is home and during the evening. Heat loss is a function of the change in temperature from inside to outside. Lowering the inside temperature reduces the rate that heat is lost from the house.

### **Big Investments: Replacement Furnaces / Boilers and Replacement Windows**

New furnaces and boilers for the house can be a substantial investment. For replacements, you should consider sealed combustion, where air used for combustion is taken in from the outside. After combustion, exhaust gasses are vented directly to the outside. This means that there is no exchange of combustion gas with indoor air. Sealed combustion is safer because combustion gasses cannot spill back into the house (potentially causing carbon monoxide poisoning). Another considerable advantage is that sealed combustion appliances are able to capture much more combustion heat and are therefore much more efficient. This means more of the heat is staying in your house and less is being pushed out the exhaust flue. If you choose to

install a sealed combustion furnace or boiler, you should also consider replacing the water heater as well. Sealed combustion or power vented water heaters are much safer because they are designed to prevent exhaust gasses from spilling back into the house. An alternative to combustion furnaces and boilers may be ground source heat pump technology ('geothermal'). While these systems promise energy savings, as heat is pumped from the ground into your house, they are also considerably more expensive to install. Replacement windows can be very expensive, but should perform much better than old single-pane windows. Products such as Renewal by Andersen or Integra by Marvin are well designed and very efficient. Installation is a critical factor. Flashing around the window is very important and air leakage should be minimized.

## **An Energy-Efficient Home**

A visitor to Heidi Joos and Ivy Booth's Linden Hills home will see many of the things that create a welcoming living space. What the visitor won't see, at least not at first glance, is that their home is a showpiece of energy efficiency, proving that environmental awareness doesn't require major sacrifice or altering one's personal tastes. When Heidi and Ivy first began thinking about how to use their financial resources to help the earth, they listed their goals: to benefit their grandkids; decrease their use of exhaustible natural resources; help promote sustainability; do their part in decreasing global warming.

During a vacation in Italy they noticed the focus on energy efficient appliances. Back home, they attended the Green Expo and saw demonstrations of energy-efficient features. They had an energy analysis done of their home, but it was 7 years later before technology made it possible for them to become first adopters, installing energy efficient systems in their home.

### **A ground-source heating & cooling system**

Buried underground, beneath Ivy's gardens, are pipes that provide the basis for the system. Fluid circulates through the pipes, which run as deep as 200 feet. The underground temperature, slightly higher than 50°F all year, is transferred to the fluid, and the pipes run the fluid through a heat pump in the home. Then, through a conversion process in the pump, warm or cool air is circulated in the home as needed. The system, commonly referred to as geothermal, was put in to replace their traditional gas furnace heat and to provide cool air in the summer. The energy savings were immediate. The first month after installation, Heidi and Ivy's energy use dropped from 211 therms of natural gas to just 11. (A therm is the unit of measurement natural gas companies use to determine your gas usage.)

### **Solar panels on their roof**

Several years ago, the couple had solar panels placed on the south-facing roof of their home to produce electricity. (*The panels were installed when rebates were given by the federal government, Xcel Energy and Linden Hills.*) Twenty-eight solar panels provide enough electricity during some months that they sell power back to Xcel Energy. The panels also provide power to run the geothermal system's heat pump. The panels are hooked to the Internet so the couple can monitor their savings in real time.

### **A high-efficiency wood-burning stove**

Heidi and Ivy put in a wood-pellet stove in their living room many years ago, the first of its type in Minneapolis. The pellets are made of compressed sawdust, a renewable waste product of lumber milling. A bag of wood pellets costs about \$4, and the stove burns slightly less than one bag a week in winter. These burners provide home heating that is environmentally cleaner and more efficient than wood logs.

### **Energy-saving appliances & other features**

Heidi and Ivy also have energy- and water-saving appliances, which are unplugged or turned off when possible, and compact fluorescent bulbs that not only save on energy costs but also produce less heat than traditional incandescent bulbs. Due to recommendations from a Centerpoint energy audit, they installed more energy efficient windows and added insulation to their attic. Their home also has a whole-house fan, which pulls cool air from outdoors through the house and expels hotter air through roof vents. And in the basement is a compost bin, filled with worms chomping their way through household organic materials.

There are very few maintenance or operating costs for these systems; the solar panels, for example, are built to sustain most types of Minnesota weather. The companies that provide these systems were knowledgeable about required permits and regulations.

If you're interested in learning more, Heidi and Ivy would be happy to provide details on how to live more green and clean. They agree that they would absolutely install these features over again. Already, several of their Linden Hills neighbors have installed geothermal heat, following their example.