STORY AND PHOTOS BY IAN RAYMOND

Green IS THE NEW Gold

SAVE MONEY—AND THE ENVIRONMENT—WITH ALTERNATIVE ENERGY

Now that the golden colors of autumn have faded, folks around Concord are preparing for the oncoming cold of another New Hampshire winter. Oil and gas prices have soared. Concerns over carbon dioxide emissions, global warming, and environmental pollution are growing, and many are looking to alternative energy to help "green" the planet and put a little "gold" back in their pockets. ▶

The Squam Lakes Natural Science Center in Holderness, NH has installed photovoltaic solar panels that produce clean electricity (no carbon emissions, mercury or other pollutants). These panels provide electrcity for their welcome center

Opposite page: Outdoor hydronic wood furnace sends heat to your forced hot water heating system.

GETTING AWAY FROM OIL

Renewable energy sources offer the homeowner lower utility bills, the promise of a healthier planet, the reduction of anthropogenic causes of global warming, while at the same time providing energy from a sustainable supply (in the case of biomass and biofuels), or infinite supply (in the form of solar, wind, geothermal, and hydropower).

In New Hampshire, heating is done primarily with petroleum products (55.3 percent of homes use fuel oil, 10 percent use propane, and 5 percent use kerosene), of which there is a finite supply. Ten years ago, home heating oil cost $0.78 per gallon. This winter that same oil will cost $4.34 per gallon, according to the Energy Information Administration. Increases in fuel prices have quickly outpaced increases in income for most people.

It is of little or no concern to most homeowners whether these price increases are caused by investment speculators, by weather events in oil producing or refining locations, by supply or delivery disruptions due to political events, by the increasing demand of developing nations, because of the weak U.S. dollar, or because, as many suspect, we have reached Hubbert's peak—the point at which oil extraction has peaked, and discovery of new petroleum supplies will be on a continual decline. What does concern them is this: How will they afford to heat their homes this winter.

LOOKING FOR SOLUTIONS

According to the U.S. Department of Energy, 69 percent of a typical U.S. home's energy use is for heat (17 percent is for domestic hot water, 52 percent is for space heating). Eighty-five percent of New Hampshire's heat energy comes from imported sources. Many residents are looking to renewable forms of energy in order to regain a sense of control over a situation that recently has seemed totally out of control.

So what's a thrifty Yankee to do? What type of renewable energy gives you the most "bang for the buck"? With so many types of renewable energy available, which systems work best in New Hampshire's climate? Since most of the energy dollars expended in New Hampshire are used for heat, we will focus on alternative sources for home heating, rather than the many other alternatives that produce electrical energy or energy for transportation.

Before we get started, it's important to mention that the least expensive energy is the energy that you don't have to buy. And, no, I don't mean running your 52-inch plasma television off an extension cord that you plugged in to your neighbor's garage—I'm talking about conservation. Before homeowners think about investing in alternative energy, they should consider hiring a professional energy auditor to inspect their home. The auditor will assess areas where your home is losing energy, using tools such as a blower door test to determine the level of air infiltration, and infrared imaging to determine heat losses due to inadequate insulation. By tightening up the building envelope you can save money immediately—even with your current heating system.

According to the New Hampshire Office of Energy and Planning, on average, proper weatherization will cut heating bills by as much as 31 percent. And if you decide on a renewable source of heat, such as solar, it will allow you to purchase a smaller less expensive system.

For homeowners on a tighter budget, look into taking the New Hampshire Carbon Challenge (www.nhcarbonchallenge.org). This program is a University of New Hampshire initiative that offers an online calculator where homeowners can plug in figures from their energy bills, and are then offered great suggestions as to how they can save energy and lower their carbon emissions in the process. Each suggestion will show how much money can be saved and how much carbon will be kept from entering our atmosphere. For the do-it-yourselfer, along with caulking, weatherstripping, and insulating, there are also products such as Warm Window which offers insulating window fabrics that can reduce window heat loss by up to 81 percent.

LONG-TERM THINKING

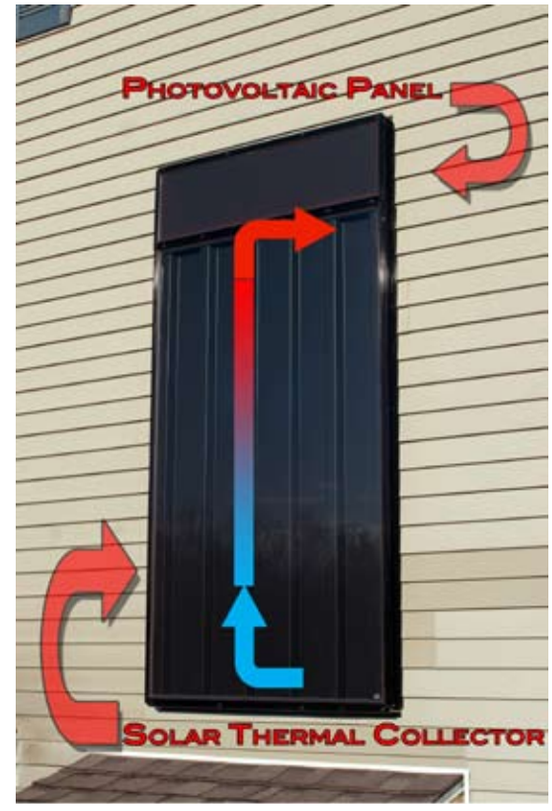
With conventional energy systems, such as those that burn fuel oil, buying decisions are often based only on initial purchase price; without much consideration given to the operational costs over the life of the equipment. When choosing a renewable energy system for your home, it's important to make your investment choice based on "life-cycle" costs (initial purchase price+installation+fuel+maintenance), particularly when comparing renewables to conventional energy systems, since renewables often have a higher initial purchase price but, once installed, may have little or no operational costs. Conventional energy systems, on the other hand, are usually less expensive to purchase but have significant operational costs for fuel and maintenance.

Renewable energy systems that work well in New Hampshire's climate include solar hot air collectors (of which I have two different units installed on my house), solar hot water collectors (my next project), biomass (a.k.a. woodstove, wood pellet stove, or outdoor hydronic wood burning furnace), and geothermal.

LET'S TAKE A CLOSER LOOK AT EACH OF THESE.

Solar energy is a popular choice, because once it is installed it provides free heat (solar thermal collectors produce either hot air or hot water); or free electricity (photovoltaic

This hybrid solar hot air colector also has a small photovoltaic panel that powers the blower fan.



collectors produce electricity). Solar energy is a clean energy—it has no polluting or global warming emissions, requires no costly fuels, requires virtually no maintenance, and provides energy at the same cost per unit throughout its lifetime—FREE!

There are two types of solar thermal design: passive and active. Passive solar design generally takes place during the initial construction of a home and deals with how the house is situated on the lot, in relation to the sun, and the judicious placement of windows (more glass on the south facing side of the house). Occasionally homes are retrofitted to include passive solar by the addition of a glass solarium. Although there are many differing designs for passive solar, one thing that they all have in common is that there are no fans or pumps used to distribute the heat. The sun's radiant energy is absorbed by items within the room, which in turn radiate that heat to warm the occupants.

Active solar also comes in many designs, but unlike passive solar, has a collector unit that is specifically designed to absorb the sun's energy, with pumps or fans to distribute the heat. The two main types of active solar collectors are hot air and liquid. Hot air collectors are the least expensive form of solar—you can build and install one yourself, for as little as a few hundred dollars. However, they work only while the sun is shining on them (www.solar-components.com has materials to build your own). They consist of a panel that is generally about 4 feet by 8 feet by 4 inches deep. The back and sides of the panel are insulated to retain the heat that is collected by the sheet metal absorber. The front of the panel is covered with a low iron glass that allows the maximum amount of the sun's radiation to hit the absorber plate. Air from the home enters through a duct at the bottom of the collector, is heated by the absorber plate, and is then blown back into the home through another duct at the top of the collector.

Some of the newer designs are hybrids that also have a small photovoltaic panel attached which produces electricity to power the blower fan. The unit I installed on my house will blow 120° F hot air into my home whenever the sun is shining. And when the sun comes up, I hear the blower fan and think...“Ah, the sound of free heat!”

Liquid collectors come in two basic designs: flat plate, similar to the hot air collector, but with the addition of copper tubing in the absorber plate through which liquid is pumped; or evacuated tube collectors, a collection of long cylindrical tubes made of thin strip absorber plates contained within an evacuated glass tube. The vacuum within the tube provides the insulation (think of it as a giant, clear Thermos® bottle). The evacuated tubes are connected to a manifold where the heat is transferred to the liquid, which is then piped into a heat exchanger inside a super insulated hot water tank. In New Hampshire's frigid winters, a food-grade antifreeze (propylene glycol) is used as the liquid medium to transfer the sun's energy into your home (water would freeze at night, bursting pipes and destroying your collector).

Liquid collectors are a bit more complicated to build and install and are therefore more expensive—perhaps from three to ten thousand dollars, depending on the size of the unit needed. While it's possible for the homeowner to take on this project by themselves, it does require a much higher degree of technical competence, for safety and to achieve optimal performance for your specific situation. Solar liquid collectors can be used to heat domestic hot water, or for space heating when connected to a radiant floor heating system. The major benefit to a liquid collector is that it can provide heat 24 hours per day because the solar generated heat can be stored in a hot water tank for use when the sun isn't shining.

WHAT ABOUT WOOD?

Another very effective form of renewable energy in New Hampshire is biomass—a.k.a wood heat. New Hampshire is approximately 85 percent forested, which provides a local source of fuel supply. It provides jobs in New Hampshire and keeps money in our local economy instead of sending it overseas to purchase petroleum. Efficiencies among wood burning appliances vary, but on average it should cost approximately 50 to 75 percent less to heat with wood than it does with fuel oil. Wood fuel is carbon neutral, which means that no new carbon is added to the atmosphere, unlike burning oil. Also, unlike oil, burning wood emits very little sulphur dioxide, one of the leading causes of acid rain.

There are four basic types of residential wood-burning appliances: fireplaces, traditional wood stoves, wood pellet stoves, and outdoor hydronic wood furnaces. Of these, fireplaces are the least efficient because a good deal of your home's heat goes right up the chimney, both when a fire is burning and when it's not. These units can be upgraded with either glass doors or a fireplace insert. The first helps prevent room heat from going up the chimney; the second may have some type of fan or heat circulation unit that will blow heated air into the room. Wood stoves work in a similar way but are more efficient at keeping the heat in your home.

Wood pellet stoves look much like a traditional wood stove, but instead of burning logs, they burn rabbit food-sized pellets made of compressed sawdust. The main benefit of wood pellets is that they don't require a full-sized chimney—only a vent pipe that goes directly out of a wall in your home. The vent pipe is twist lock so the homeowner can very easily disassemble it for cleaning out soot.

Another benefit is the fuel itself. It's clean and easy to transport. It comes in 40-pound bags that can be stored in your home without introducing the insect infestation or general

When harvested sustainably, wood is a cost effective renewable resource, that provides local jobs and keeps energy dollars here in New Hampshire.

Wood pellets provide the cleanest burn of any solid fuel. One ton of pellets has the same heat value as 1-1/2 cords of wood, but can be stored in 1/3 of the space.

"Be the change you want to see in the world." — Ghandi

dirt that you might expect from the storage of cord wood. The downside of these appliances are two-fold: because so many people are switching over to wood pellet stoves, the pellet manufacturers are, on occasion, having a difficult time matching supply to the demand. Locally, I found one supplier had a waiting list containing the names of 58 customers, while another supplier had 353 40-pound bags in stock. Secondly, these units require electricity to operate. They draw a maximum of about 500 watts, so when the power goes out in a winter storm, I plug my pellet stove into a power inverter connected to a battery. Problem solved (for a while at least).

ANOTHER OPTION FOR WOOD

Outdoor hydronic wood furnaces act like a fuel oil fired boiler, except that they are housed in a shed style building outdoors. Pipes are run underground below the frost line and connected to your forced hot water heating system. Some of the benefits include the ability to use oversize logs, to burn scrap woods that you wouldn't burn in a fireplace or wood stove (pine, for example, although you still get more heat BTU's from hardwoods; or lumber scraps as long as they haven't been pressure treated, painted, or contain glues).

Much of this fuel supply you may be able to get for free if you're willing to do a little work. Another benefit is the short smoke stack, making chimney cleaning much easier for the do-it-yourselfer. And because the fire is burned at a remote location that is not attached to your home, the risk of house fire is much lower.

ABOUT HEAT PUMPS

The last topic is geothermal energy, also known as heat pumps. These units take advantage of the fact that the temperature of the earth six or more feet below the surface remains at a relatively constant temperature (45° to 70° F.) This system uses hundreds of feet of pipe buried either horizontally or vertically, through which fluid is pumped that extracts this heat energy from the earth. The system uses compressors to amplify this heat energy, and heat exchangers to transfer it to air ducts, if the home uses forced hot air heating; or to radiant floor heat. This system works similarly to an air conditioner, cooling the home in the summer; and in the reverse, heating the home in the winter. These systems can be quite expensive to install, particularly as a retrofit, so it would be wise to do a careful cost/payback analysis if you are considering geothermal.

Regardless of which alternative energy system you choose, make sure you check out the Database for State Incentives for Renewables & Efficiency (www.dsireusa.org). This website contains information on tax exemptions, tax credits, and other incentives you may be eligible for when you install your system.

If you are building a new home and are looking to save energy, consult with an EnergyStar or LEED (Leadership in Energy and Environmental Design) certified builder ahead of time. It's often much cheaper and much more effective to have your home designed with energy efficiency in mind than it is to try to incorporate energy efficient measures after construction has begun. Also, talk with your lending institution. Many are now offering energy efficient or "green" mortgages. Because you will be saving money on your energy bills, they will allow a higher debt-to-income ratio, allowing you to qualify for a larger loan amount.

Upgrading your home's energy efficiency makes sense. You will increase the value of your property, cut pollution, consume less, save money, and maybe even change the world.

As Ghandi said, "Be the change you want to see in the world."

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