



Courtesy solarassist.net

First Steps in Renewable Energy *for Your Home*

by Phil Livingston

The bulk of our energy comes from coal, oil, and natural gas—exhaustible resources that create pollution when burned and contribute to global warming. Renewable energy (RE) is nonpolluting energy that comes from inexhaustible resources, such as wind, sunshine, and falling water. Using more RE and less nonrenewable energy means less pollution produced. Plus, RE can provide personal and national energy security—freeing you from a lifetime of utility bills and reducing the United States’ reliance on imported fuels.

Conservation & Efficiency

Many people get entranced by RE technologies—solar-electric (photovoltaic; PV) modules, and microhydro and wind turbines. But the first focus of anyone wanting to invest in RE should be conservation and efficiency.

Conservation involves changing your energy use behaviors from wasteful, inefficient habits (such as leaving on the lights when you leave a room) to energy-saving ones (turning off the lights every time you leave a room). This is a conscious choice—although you are using the same fixtures, you’re making an effort to minimize your energy consumption.

Efficiency, on the other hand, is reducing energy consumption—without changing your lifestyle—by using efficient appliances. As energy efficiency expert Amory

Lovins once said, energy efficiency is a “technical fix.” Using the previous examples, the efficiency solution would be to swap out incandescent lightbulbs with compact fluorescents (CFs), which only use about a quarter of the energy.

Both conservation and efficiency work hand in hand. Apply the basic principles of conservation and efficiency to *all* of your energy choices, *before* looking at harnessing renewable energy. It makes very little sense to put PVs on your roof before you have CFs in your light fixtures.

Conservation and energy efficiency are low-hanging fruit, to be picked before moving forward with solar electricity or hot water systems. By reducing your energy demand, you will greatly reduce the cost of your RE systems when you’re ready to have them installed. Every dollar you spend

on efficiency measures will save you roughly \$3 to \$5 on your renewable energy system costs.

Energy Efficient Appliances

Using efficient appliances can make a world of difference in the amount of energy we consume. Huge advances have been made in a variety of appliances. Here are a few examples:

- Incandescent bulbs produce 95 percent heat and 5 percent light—little has changed since the days of Edison. Welcome to the 21st century—let's try something new. When you think of compact fluorescent lights, try not to picture the flickering harsh light of years gone by. Check out some of the new CFs on the market—you will be pleasantly surprised. Modern CFs provide superior light quality, with operational lifetimes eight to ten times longer than that of an incandescent and one-quarter the energy use, to achieve the same amount of lighting.
- In the 1970s, the average refrigerator consumed about 1,500 KWH per year. Today, this number has dropped to about 500 KWH for efficient models. If your refrigerator is more than five years old, replacing it with a more energy efficient unit is a good place to start. Energy Star-qualified refrigerators use 40 percent less energy than conventional models sold in 2001.
- In the past decade, improvements have been made in clothes washer and dryer technologies. New, energy efficient washers agitate on a horizontal axis rather than a vertical one, decreasing the amount of water needed in the washer. Less water used means reduced water-heating bills. The new breed of washers also spins out more water than previous machines, so clothes require less time in the dryer, reducing electricity or gas use. Improvements have been made in dryer technology as well. Dryers now have temperature and moisture sensors, which automatically shut them off when your clothes are dry.

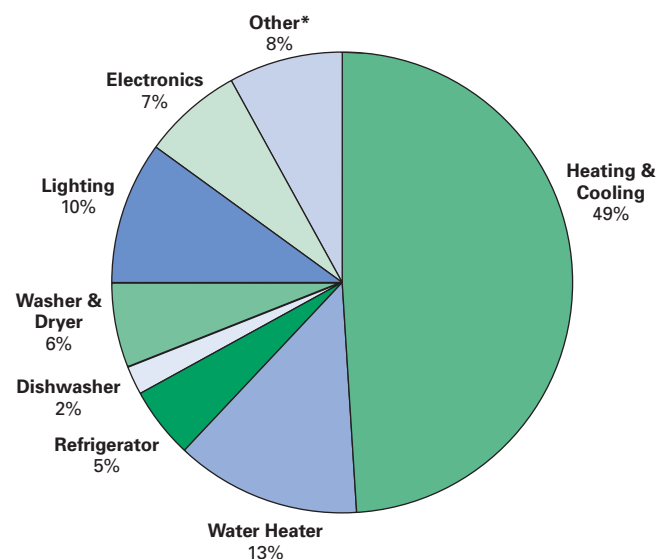


Sealing draft-prone areas, the points at which dissimilar building materials converge or the building envelope is penetrated, reduces uncontrolled air infiltration. Combine this with increased insulation and you can reduce the amount of heating, ventilation, and air conditioning needed to sustain a comfortable household temperature throughout the year. This translates directly into greatly reduced heating and cooling costs, and less environmental pollution.

Passive Plans

If you're building a new home, seriously consider a passive solar building design—it's an inherently superior way to both heat and cool your home. Passive solar houses balance a carefully calculated amount of glazing (windows) with heat absorbing thermal mass (concrete slabs or other masonry material) located on walls and floors in the direct vicinity of the southern exposed windows. Properly sized window overhangs block the high summer sun and prevent the building from overheating, while allowing the low winter sun to enter and warm the space. Another key to passive solar design is to have minimal window area on the north, east, and west sides of the house, to minimize heat loss during cold months and heat gain during the hot months.

Typical Household Energy Use



*Other represents an array of household products, including stoves, ovens, microwaves, and small appliances like coffee makers and dehumidifiers.
Courtesy of www.energystar.gov

Heating & Cooling

As shown on the pie chart, heating and cooling account for almost 50 percent of the typical American home's annual energy consumption. Because heating and cooling take such a big bite out of the energy pie, if you're serious about conservation and efficiency, you'll start by improving your home's insulation and reducing air infiltration.

Wall, roof, and floor structures separate the inside of your house from outside, and are referred to as a building's envelope. How this envelope is designed and constructed is the deciding factor in how good the thermal boundary is between you and the outdoors. Many of us use a thermos to transport liquids because its thermal boundary affords us the luxury of cold lemonade on hot days and hot chocolate on cold days. We want our home to be a thermos of sorts. By designing a building with a tight, well-insulated envelope, you will minimize the energy consumed to keep your home at a comfortable temperature.

Courtesy www.windenergy.com



Renewable Energy Options

There is no cookie-cutter solution for what type of renewable energy system will be most effective and economical in any given application. Many factors must be balanced to develop a good design, including proper siting, environmental resources, financial incentives, social considerations, and environmental effects. Here is some real-world advice concerning each of the major technologies. Additional reading to get you on the right track is provided at the end of this article (see Access).

Solar Hot Water. Solar thermal systems include a rather large category of energy collection and distribution devices for pool heating, domestic water heating, and space heating via radiant floor heating or water-to-air heat exchangers. You should consider all these options during the design phase of your project.

Installing a solar domestic hot water (SDHW) system is one of the best investments homeowners can make to reduce their electric or natural gas water heating bills, with typical financial paybacks at less than eight years. Depending on the size of the system you install, your local climate, and your hot water use, SDHW systems can cut your water heating bills by 40 to 80 percent. Systems have been designed for all types of applications. Whether you live in the farthest reaches of Alaska, in cloudy Seattle, or by the beach in Jamaica—an SDHW system can work for you.

Solar Electricity. The use of residential solar-electric systems began decades ago in rural locations where utility electricity was not available. While the number of off-grid PV systems continues to grow, grid-tied PV systems are an increasingly popular urban and suburban option for generating clean, sustainable electricity. Not to be confused

with solar heating (which uses the sun's heat to warm air or water), PV modules use photons in sunlight to excite electrons and generate electricity. PVs have no moving parts, are virtually indestructible, and typically carry a 25-year warranty.

You'll face a major choice when planning a grid-tied PV system (and increasingly with wind and microhydro systems)—will you have batteries or not? If your primary motivation is environmental, a batteryless grid-tied system is probably the best choice. Batteryless systems are simple, economical, maintenance free, and highly efficient. If your home experiences frequent or extended utility outages that are an inconvenience to you and your family, then you may want to consider a system with battery backup.

Wind Electricity. Wind energy can be quite economical if your site has an adequate wind resource. Optimal, consistent wind resources are not located near buildings or down among the trees.

Rather, they are found at least 30 feet above all nearby obstructions. Tapping wind energy involves tall towers, which need to be engineered specifically for the turbine you are installing. Wind turbines come in a variety of shapes and sizes, with many different specifications.

Microhydro Electricity. If you have a stream running through your property that drops along its course, tapping its energy potential may be economical. With microhydro, as with all renewable energy technologies, you must weigh the economics at each site based on the resources at hand. Opportunities for installing a microhydro system are often few and far between, but if your stream has significant water flow or a large vertical drop (head), you're in luck. Even streams that only flow seasonally can be good candidates for generating electricity. Unlike PV or wind systems, hydro systems generate electricity continuously, as long as the water is flowing, and will typically be the most cost-effective renewable energy approach.

The Big Picture

Energy efficiency is always the most affordable and environmentally sound place to start when approaching renewable energy. By doing something as simple as swapping out incandescent lightbulbs with compact fluorescents, you can decrease the number of PV modules needed to power your lighting by up to 75 percent. This principle applies to all choices you make as you use energy. Focusing on the demand side first will always be your best bet.

Think through your renewable energy choices carefully, evaluating where best to spend your money. Look at your energy appetite and needs, your site, and the resources available to you. As you move towards less and less reliance on nonrenewable energy, you'll be gaining some

independence from the utility companies, reducing your monthly bills, and minimizing the impact our energy use has on the environment.

Access

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The Home Energy Diet, by Paul Scheckel, 2005, Paperback, 304 pages, ISBN 0865715300, \$18.95 from New Society Publishers • 800-567-6772 or 250-247-9737 • www.newsociety.com

Selected Articles from *Home Power* Back Issues:

Energy Conservation, Efficiency & Analysis:

"Starting Smart: Calculating Your Energy Appetite," Scott Russell, *HP102*

Passive Solar Design:

"Designing Your Place in the Sun," by Debra Rucker Coleman, *HP116*

"Home Sweet Solar Home: A Passive Solar Design Primer," Ken Olson & Joe Schwartz, *HP90*

"Be Cool: Natural Systems to Beat the Heat," Preethi Burkholder & Claire Anderson, *HP108*

Solar Hot Water:

"A Solar Hot Water Primer," Ken Olson, *HP84*

"Solar Hot Water Simplified," John Patterson, *HP107*

Microhydro Electricity:

"Microhydro-Electric Systems Simplified," Paul Cunningham & Ian Woofenden, *HP117*

"Intro to Hydropower: Parts 1-3," Dan New, *HP103, 104 & 105*

Wind Electricity:

"Apples & Oranges 2002: Choosing a Home-Sized Wind Generator," Mick Sagrillo, *HP90*

"Wind-Electric Systems Simplified," Ian Woofenden, *HP110*

Solar Electricity (PV):

"Solar-Electric Systems Simplified," Scott Russell, *HP104*

Other Resources:

American Council for an Energy Efficient Economy • www.aceee.org

Database of State Incentives for Renewables & Efficiency • www.dsireusa.org

Energy Star • www.energystar.gov

PVWatts • http://rredc.nrel.gov/solar/codes_algs/PVWATTS

PV Sizing & Payback Calculator • www.ongrid.net/payback

