Welcome to the Whole-Building Approach!

Did you know the building decisions you make today will affect the environment and your wallet for years to come? That’s why you should consider your home’s total environmental and energy-saving potential before you build or buy.

A Winning Combination—Design, Efficiency, and Solar Technology

DESIGN—a crucial part of the whole-building approach is design. Building design can make a big difference in energy savings. Low energy design creates bright, beautiful interiors that use the sun’s energy to heat the home in the winter and design to cool it in the summer. Most basic is a design that lets sunlight in through large south-facing windows. But designs do more than bring sunlight into the home—they also block it. Window overhangs reduce cooling costs by shading rooms from too much heat in the summer when the sun is higher in the sky. During the winter, when the sun is lower in the sky, more sunlight can enter your home because the sun won’t be blocked by the window overhang. Another energy saving design feature is landscaping that shades your house from scorching summer heat and icy winter winds. Plant low shrubs and plants on the south side of your home to cool it in the summer and also to shade your home from the sun’s energy too, such as putting the most heat-producing room in the house, the kitchen, on the north or coolest side of the home. This north side is also a good place to put storage and other low occupancy areas such as utility rooms and bathroom. Designing your house to capture all the sun’s energy to lower your energy bills, will provide an attractive floor plan with large windows for views and sunny interiors. With less noise from heating and cooling systems, it will also be quieter.

EFFICIENCY—now that your home is designed, let’s look at its efficiency. It allows you to make the most of your building design and solar technologies. The typical house—with items such as a dishwasher, a refrigerator, and other appliances—consumes considerable energy. Check energy-guide labels on appliances and try to choose those that require less energy to operate, not the ones with the lowest price tag. It may cost more up front, but it will save you money over the long term. For example, front-loading washing machines use half the energy of traditional machines. The new compact fluorescent lights use one fourth to one sixth the energy of incandescent bulbs, last longer, and are virtually indistinguishable from traditional lighting. Energy efficiency also applies to windows and doors. For example, windows now exist with added coatings that reduce heat leak. In the wall, loose-fill insulation results in less heat transfer than the irregularly shaped voids to seal air-leakage spots. Don’t forget about energy conservation, heating, and cooling as well. Caulking and weatherstripping is a great place to start. Using programmable thermostats to regulate the interior temperature is another energy-saving step. A door draft stopper or weatherstripping, for example, reduces the infiltration of heated or cooled air through your doors. A water heater will also conserve energy. Energy conservation and efficiency measures will lower your home’s energy demand and allow you to use conservation and efficiency measures will lower your energy savings and make the most of all your building elements. It reduces the amount of energy required to operate your home compared to conventional houses. It improves the comfort levels of your living space, so you can take advantage of today’s advanced building materials and solar technologies into your home’s design. Finally, it will increase the value of your home’s solar systems because they will meet a greater portion of its energy needs.

SOLAR TECHNOLOGY—in the last 20 years, solar technology has made giant strides. As a result, a variety of solar technologies can now be combined with conventional architecture to address your home’s heating, cooling, and electrical needs. For heating and cooling, heavy building materials such as brick and stucco can be incorporated into the interior design of your home to store energy—something referred to as “thermal mass.” Thermal mass is typically part of a “passive solar” system, in which solar energy enters through south-facing glass and is stored in the thermal mass to heat the home in the winter. Passive solar, or “solar mass” helps keep the house cool in the summer by moderating the temperatures. For heating, a wood stove in a passive solar home can provide all the energy needs. Generally, you will pay more for rooftop to heat water circulating to the roof by pumps from storage tanks, usually found in the basement or crawl space. It is strategically placed to absorb the sun’s energy. The advantage is that you can connect your solar electric system to a local utility grid and get credit from the utility for the excess power. The cost of a PV system varies with system size, in general, a 3 kw system will meet 90% of the electrical load needed by the average residential house. Be aware, however, that the rated capacity of the PV panel is for ideal conditions—practical experience shows actual measured outputs are about 30% below the rated value in most climates.

The Foundation—Planning

Planning before you build your home is important—it determines how efficiently your home will use the sun’s energy. Planning involves four things: positioning your home to make the most of the sun’s energy, taking inventory of your energy needs, deciding who will design and install your solar systems, and discovering your financing options.

Other possible benefits are a “grid-free” lifestyle with no connection to a utility power line. Some people like this increased energy security of not being completely dependent on their utility company. But the most important reason to build your solar home using the whole-building approach is cost-effectiveness because each individual component will perform optimally, complementing the others. We encourage you to work with your architect or builder to integrate today’s advanced building materials...
How Low-Energy Design and High-Performance Power Work Together

APPLIANCES
- Appliances account for about 20% of your household's energy consumption, with refrigerators and clothes dryers at the top of the consumption list. Look for the ENERGY STAR® label when shopping for appliances for long-term energy savings. Select front-loading washers and install the flood water fixtures to reduce your demand for hot water.

INSULATION
- Insulation thermally increases your home's exterior to keep your home cool during the summer and warm in the winter. The higher the R-value, the better.

LANDSCAPING
- A well-designed landscape will cut heating and cooling costs dramatically by protecting your home from hot summer sun and cold winter winds. Use low-vegetation inside your southern solar-access area to keep your windows, solar hot-water or solar-electric systems open to the sun's energy. Locate large shade trees to protect east and west sides. Selecting native plants and trees will also conserve water.

LIGHTING
- Compact fluorescent lamps are more energy efficient than incandescent and halogen lamps. They cost more initially, but last up to 10 times as long and can save up to 75% on energy costs, resulting in a better bulb over time.

ORIENTATION
- Make the most of the sun's energy—choose southerly-facing solar systems and windows. Too much summer sun can increase your cooling costs, so be sure to shade windows with overhangs in the summer.

Solar Electric
- Photovoltaic modules convert solar energy into electric current (DC) electricity. An inverter converts DC electricity into alternating current (AC) electricity that can be used by most standard appliances. Some new solar modules have built-in inverters.

SOLAR HEAT
- Solar Hot Water: Solar water heaters collect the sun's thermal energy in panels mounted on the roof of your house and use it to heat water. Pumps move the heated water from the collector to a storage tank, usually located in the basement or utility room. The solar water system shown to the right is a typical configuration for domestic hot-water heating. By adding more solar panels (such as shown on the house to the left) and a second heat exchanger (usually located near the storage tank), solar-heated water can also be used for space heating.

WINDOWS
- Windows are a major source of heat loss and gain. To significantly reduce your winter heating and summer cooling loads, choose window location and type carefully.

OVERHANGS - Shading windows with overhangs is important to allow light into the home during the winter and to block solar heat gain during the summer. Lengthening the overhang by just several inches can cut cooling bills by tens of percent.
If you want to hire someone who will make sure your new home is energy efficient and uses today's solar technologies, an alternative to finding a good architect could be a high-quality, factory-built solar home. Showcased on this page is a home built for the Cahill family.

Jim Cahill, an engineer and experienced builder himself, decided to buy a factory-built home after visiting the manufacturer's factory. "I was skeptical at first, but what I witnessed was better quality control and more efficient construction than I ever see in the field," he said. "That's what sold me." Cahill was impressed with the modern building techniques, such as "computer-cut" lumber and screw-and-glue assembly. The framing wood is dry; walls, ceilings, and floors are square and level; and the homes are "over built," according to Jim, because they have to travel long distances to their sites. Cahill also found, after looking at the available designs, that passive solar had become what he calls "more visually digestible." This was important because the Cahills like the look of a traditional colonial design and wanted to be sure their home would harmonize visually with other moderate- to high-priced custom homes in their area.

Jim and Janice Cahill moved into their beautiful new 2-story, 4-bedroom, factory-built colonial home in Massachusetts for about $35,000 less than it would have cost to build a similar-quality conventional custom home in their neighborhood. The Cahills spend about $110 per year on heating, cooling, and electricity, while their neighbors will be paying utility bills of more than 10 times that much.

Another Solar Option: Factory-Built Homes

Large south-facing windows provide direct solar gain to the interior of the home, while dark-colored tile absorbs and holds heat from the sun.

Solar energy meets 78% of this home's heating needs. The 16 PV modules, which can be factory-installed or site-mounted on the roof, provide virtually all of the home's electricity. (Manufacturer: AvisAmerica homes.)
Information on Buildings, Department of Energy:
This brochure is available electronically:
www.nrel.gov/buildings/pv

• Consumer Energy Information:
  www.eren.doe.gov/consumerinfo
• National PV Program:
  www.eren.doe.gov/pv
• National Center for Photovoltaics at the National Renewable Energy Laboratory:
  www.nrel.gov/pv
• Office of Building Technology:
  www.eren.doe.gov/buildings
• Solar Buildings Program:
  www.eren.doe.gov/solarbuildings
• Home Energy Saver Tips online:
  www.eren.doe.gov/consumerinfo/energy_savers
• Consumer’s Guide to Buying a Solar Electric System:
  www.nrel.gov/pv/pdfs/26192.pdf
• NREL High-Performance Buildings:
  www.nrel.gov/buildings/highperformance

Federal and State Incentive and Financing Information:
• Million Solar Roof Program:
  www.millionsolarroofs.org
• The Borrower’s Guide to Financing Solar Energy Systems:
  www.nrel.gov/pv/pdfs/26242.pdf
• State Energy Alternatives:
  www.eren.doe.gov/state_energy

Solar Organizations online
• American Solar Energy Society:
  www.ases.org
• Solar Energy Industries Association:
  www.seia.org
• Sustainable Buildings Industry Council:
  www.sbicouncil.org
• American Council for an Energy-Efficient Economy:
  www.aceee.org
• Alliance to Save Energy:
  www.ase.org

How To Build A Better Home
Use solar energy and the whole-building approach to reduce your environmental impact, live in comfort, and save money.