

Better Buildings Series

A Winning Combination—Design, Efficiency, and Solar Technology

Basics of a Solar Electric System

Today's solar technologies are more efficient and versatile than ever before, adding to the appeal of an already desirable energy source. Solar electric systems, which use a natural source of power—sunlight—produce less pollution than traditional forms of electrical production. And they can offer homeowners the security of producing their own power.

more power than is required for the house, the utility may offer the homeowner credit for the excess power produced through a program called “net metering” or “net billing.” Your state energy office or local utility can provide more information.

- **Batteries** are used to store solar-produced electricity for nighttime or emergency backup power. Batteries may be required in locations that have limited access to power lines, as in some remote or rural areas.
- If batteries are part of the system, a **charge controller** is included to protect them from being overcharged or drawn down too low.
- Finally, **disconnect switches** allow the power from a solar electric system to be turned off to provide safety during maintenance or emergencies.

Most providers of solar electric technologies can supply you with all the components you will need for a fully functional system.

Choosing Solar Modules

In purchasing solar modules, you will be seeking a balance between the best cost and years of reliable service. Most solar electric modules on the market today are composed of solar cells made from either crystalline or amorphous silicon. Crystalline silicon solar cells have been used since the 1950, whereas amorphous silicon is a newer and more common technology. If you have a calculator without a battery, it is likely powered by a very small amorphous silicon solar cell. Other new materials, such as cadmium telluride and copper indium diselenide, are now being used to manufacture thin-film solar cells.

“Thin-film” solar panels give consumers more design options because they require less semiconductor material, and can be



AstroPower, Inc./PIX08969

This 4.8-kilowatt solar electric system, mounted on a home in California, is grid-connected and has a battery backup.

Components of a System

Interconnected solar cells, which convert sunlight directly into electricity, form a solar panel or “module,” and several modules connected together electrically form an array. Most people picture a solar electric system as simply the solar array, but a complete system consists of several other components.

- An **inverter** converts the direct current (DC) electricity produced by the modules into alternating current (AC) electricity for powering lights, appliances, and other needs.
- **Wiring** connects the various components of a solar electric system. In some cases, the system is also interconnected to the utility power grid. If the system produces

SOLAR ELECTRIC

made on flexible materials such as plastic or thin stainless steel. This feature has led to thin-film solar panels resembling traditional roofing materials such as shingles that serve a dual purpose—protecting your roof while generating electricity for your house.

Choosing a System

So what system is best for your home? Your decision will depend primarily on how much energy you require to operate your home, but also on aesthetics. For example, you can purchase thin solar modules that resemble traditional roof shingles, standing-seam metal roofs, or slate tiles.



Herman Gyrf/PIX09520

Atlantis Energy SUNSLATES (roofing tiles) and AstroPower solar electric modules comprise the 5-kilowatt system on this home in Palo Alto, California, which has a battery backup and is also linked to the local utility.

Location is one decision that won't vary for different types of systems. Solar electric systems work best when placed on an unshaded roof or in a yard having no obstructions to sunlight. Observing the potential location for your system throughout the day will help you spot any shadows that might be cast across the system at different times.

Modules are usually mounted directly onto a south-facing roof (in the Northern Hemisphere) or integrated into the roof itself. However, they can also be used as skylights, placed on a vertical wall, or mounted on a structure apart from the building. Some modules can be mounted on a tracking system, which allows them to directly face the sun throughout the day for increased energy production.

Don't worry if your home doesn't face exactly south—the solar electric system will



Tim Ellison, ECD/PIX04473

still work, although you may need more modules to meet your electrical needs. Talk to your distributor or manufacturer about the benefits and costs of several types of solar electric systems before you make a decision about which type of solar electric system is right for your home.

For more information about purchasing a solar electric system, see the "Consumer's Guide to Buying a Solar Electric System," available online at www.nrel.gov/ncpv/pdfs/26591.pdf or contact the NREL Document Distribution Service, at (303) 275-4363, for a copy by mail. State-specific guides are also available for California, Arizona, Colorado, and the Mid-Atlantic region (Pennsylvania, Virginia, West Virginia, Delaware, District of Columbia, Maryland, and New Jersey) at www.eren.doe.gov/pv/onlinelrn.html

The Maryland townhouse on the right uses a solar electric system, which is integrated into the standing-seam roof. The modules look and perform like the standard metal roofing on the other units, but they also produce electricity.



David Parsons/PIX06301

Can you find the solar electric shingles in this photo? Each shingle, made from amorphous silicon, produces 17 watts of power under full sun.



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