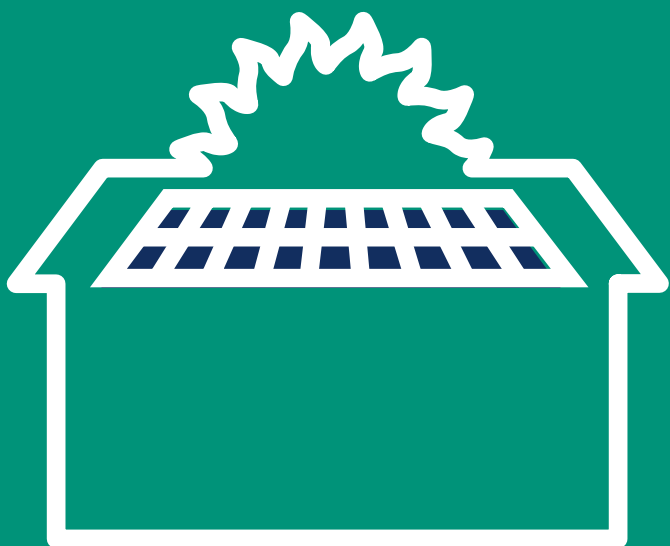


# A Quick Guide to Solar Electricity



## What is solar electricity?

Solar-electric or photovoltaics (PV) technology converts sunlight directly into electricity. You may be more familiar with PV cells as solar cells that power watches and calculators. But PV can do much more. It can provide electricity for residential and commercial buildings, including power for security lights and air conditioning. PV can also generate power for pumping water, electrifying fences, or aerating ponds.

This brochure answers some basic questions about PV energy systems and points you to sources of more information. The photographs show various ways to integrate photovoltaics into residential and commercial buildings.



## Why use PV?

The sun generates enough clean energy in one day to provide a year's supply of energy for your home or office. Why not tap into this abundant resource of clean energy? PV preserves the earth's finite fossil-fuel resources—coal, oil, natural gas—and reduces air and noise pollution associated with these energy sources. Consumers and businesses also benefit from PV when faced with power outages and future electricity price increases. Recent technological breakthroughs, combined with federal and state programs and incentives, have greatly reduced the costs of PV ownership. PV system reliability and durability are outstanding—typical PV systems may last 30 years with minimal maintenance.

## What does a typical PV system look like?

A typical PV system consists of solar cells connected electrically to form a **module** that can measure two to four feet wide and four to six feet long. Some solar modules look just like traditional roof shingles. Many interconnected PV modules are called an **array**. An array is often mounted on the roof of a building, facing south at an angle, so that the modules receive the maximum amount of sunlight. You can also mount the array on a tracker so that it moves to follow the sun, allowing the modules to capture the most sunlight over the course of a day. Other typical features of a PV system are an **inverter**, which changes your electricity from direct current to alternating current so it can be used by most standard appliances and computers. **Batteries** may also be added for emergency backup in the event of power outages or in cases where your PV system is not connected to utility power lines.

## How can I use PV in my home or business?

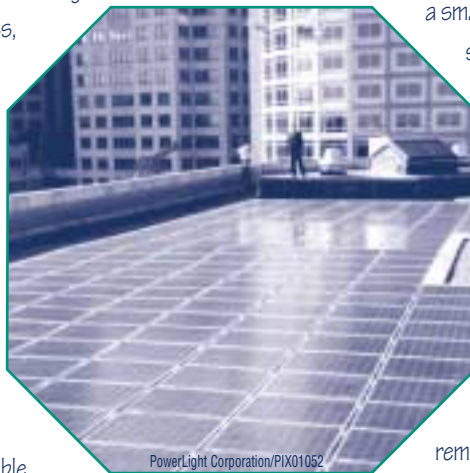
Today's PV systems can be blended into virtually every conceivable structure for homes or commercial buildings. You can find PV being used outdoors for security lighting in gardens, parking lots, and bus shelters. These PV structures can also serve as cover that generates power at the same time. Inside family homes or high-rise office buildings, PV can be used for the operation of all electrical systems, including lights, cooling systems, and appliances. PV systems should be sized according to your electricity needs and budget. In general, PV systems in buildings are sized such that the PV system fully or partially meets the building loads. Those loads will be easier to meet when the building is energy efficient. If your home or building is already connected to a power line, you may be able

to get credit for your "net" electricity—the amount of power consumed from the utility minus the power generated by your PV system—through an arrangement with your local electric utility company called "net metering". If your electricity consumption exceeds generation by your PV system, you simply obtain the needed electricity from your utility, as usual.

## Is my home or office building a good place for a solar system?

A PV system needs unobstructed access to the sun's rays for most or all of the day, throughout the year. Don't worry if you live in an area with a changing climate. PV modules are relatively unaffected by severe weather. In fact, some PV cells actually work better in colder weather. PV modules are angled to catch the sun, not snow, so any snow that does collect melts quickly. Even hail won't harm them. But you will need adequate roof space to mount your PV system. Most residential systems require as little as 50 square feet (for a small "starter" system) up to as much as 1,000 square feet for larger systems. But remember, an energy-efficient building needs

a smaller PV system. A typical one-kilowatt system would occupy from 80 to 360 square feet. A PV system can be installed on any type of roof, although some roof types are simpler and cheaper to work with than others. If your roof is older and needs to be replaced in the very near future, you may want to replace it at the time the PV system is installed to avoid the cost of removing and reinstalling your PV system.



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## How can I select a PV dealer?

If you want to purchase a PV system, you are probably going to need a PV dealer/installer. It is recommended that you contact the local chapter of the Solar Energy Industries Association (SEIA), your local Regional Office of the U.S. Department of Energy, or your state energy office for assistance. Several states with PV grant programs allow consumers to select any PV installer they wish, whereas others require customers to work with a qualified installer through a competitive bid process. You may also check your local phone directory under Solar Energy Equipment. Unless the state has specified an installer, it is always advisable to obtain several bids before making a selection. Verify their PV installation credentials and compare prices for equivalent systems. The bids should also include the total costs for getting the system up and running, including hardware, installation, connection to the grid, permitting, sales tax, and warranty.

## How can a PV dealer help?

PV dealers can help you:

- Assess the amount of sunlight you get in your geographic location
- Determine the kind and size of PV system you need
- Analyze costs of different PV or utility systems
- Install and maintain your PV system
- Assist with permitting issues such as building and electrical permits, homeowner associations, and required National Electric Code and IEEE certifications.

## How much does a PV system cost?

The price of your PV system will depend on a number of factors, including system size and the energy efficiency of your home or office building. A one-kilowatt system, which will offset a large percentage of the electrical needs of a very energy-efficient home, may cost \$6,000 to \$10,000 installed, or \$6 to \$10 per watt. At the high end, a five-kilowatt system, which will completely offset the energy needs of many conventional homes, may cost \$30,000 to \$40,000 installed. For an existing building, past electricity bills can be used to determine electrical demand. Before you size your system, however, try to reduce the energy consumption of your home or office building by making it more energy efficient.

Ultimately, both commercial and residential PV system costs will depend on your system's configuration, your equipment options, and other factors, such as how you incorporate PV into your building's architectural design. Your local PV supplier can provide you with estimates or bids.

## What incentives are available to help reduce the cost?

In some states and municipalities, incentives are available to help "buy down" the cost of PV systems or otherwise make them easier to finance. These incentives may include tax credits, state grants, and low-interest financing packages. Businesses may be entitled to a 10% federal tax credit and accelerated depreciation on the PV system. These tax benefits can substantially reduce the effective cost of your PV system and should be thoroughly investigated. Contact your state energy office to find out what grants and incentives are available.



## How can I finance the cost of my PV system?

Several options are available, including new state and federal programs and tried-and-true financing approaches such as mortgage loans. Mortgage financing options include your primary mortgage, a second mortgage such as a U.S. Department of Housing and Urban Development Title 1 loan, or a home-equity loan that is secured by your property. If mortgage financing is not available, look for other sources of financing, such as conventional bank loans. Because your PV system is a long-term investment, the terms and conditions of your PV financing are likely to be the most important factor in determining the effective price of your PV-generated power.

## Who can I contact for more information?

We recommend that customers contact the U.S. Department of Energy for general PV questions or for a copy of Consumer's Guide to Buying a Solar Electric System. The National Center for Photovoltaics is another source of information about PV. SEIA can

help you with selecting a qualified installer in your area. Contact your state

energy office about programs, incentives, or grants available in your state for the purchase of PV systems. **We must emphasize that some state programs and incentives may save you up to 50% of the cost of a PV system, so it is definitely worthwhile to contact your state energy office before making a purchase decision.**



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## The President's Million Solar Roofs Initiative

[www.MillionSolarRoofs.org](http://www.MillionSolarRoofs.org)

## Consumer's Guide to Buying a Solar Electric System Online

[www.nrel.gov/ncpv/pdfs/26591.pdf](http://www.nrel.gov/ncpv/pdfs/26591.pdf)

## Home Energy Saver Tips Online

[www.eren.doe.gov/consumerinfo/energy\\_savers](http://www.eren.doe.gov/consumerinfo/energy_savers)

## U.S. Department of Energy

Energy Efficiency and Renewable Energy Network

P.O. Box 3048 • Merrifield, VA 22116

1-800-363-3732

[www.eren.doe.gov](http://www.eren.doe.gov)

## Solar Energy Industries Association (SEIA)

1616 H Street, 8th Floor • Washington, D.C. 20006-4999

202-628-7745 • fax 202-628-7779

[www.seia.org/main.htm](http://www.seia.org/main.htm)

## National Center for Photovoltaics

National Renewable Energy Laboratory

1617 Cole Blvd. • Golden, CO 80401

303-384-NCPV (6278)

[www.nrel.gov/ncpv](http://www.nrel.gov/ncpv)



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