



# Is photovoltaic technology the answer to high energy costs?

By Sandra Frost

Photovoltaic (PV) units are a high-tech method for capturing energy from the sun. Units can be panels or thin film.

Two worldwide forces are operating to reduce the installed cost of PV units. First, costs of crystalline cells used in panels are decreasing due to increasing world supplies of industrial silicon. Secondly, the thin-film PV industry is competing strongly against the crystalline cell panel industry. This is good news for consumers.

Comparison of conventional utility cost per kilowatt hour (kWh) and installed cost of PV units per kWh will provide financial information criteria for your decision.

Careful consideration of your present energy situation, energy goals, advantages, disadvantages, PV efficiency, your geographic site, and local building codes provide additional information upon which to decide whether PV units are appropriate for a home or business.

Many owners of PV systems have also chosen PV based on philosophic belief that renewable energy sources are more sustainable in the long-term than fossil fuel consumption.

## Begin by gathering data to describe your present energy situation

Measure and record the amount (kWh), types (AC/DC), time of year (monthly), and time (day/night) of energy consumption. List appliances and their energy requirements and any new energy consumption being planned. The

information provides what months the most power is needed. Climate conditions during those months will be important. Cloud cover will decrease the amount of PV energy available. Time of day is important because only a "day use" system without storage may be required, or a set of batteries may be needed to store power for night use. Appliances are important because those with low energy requirements will reduce the load on the PV system.

## Define future energy goals

Do you want to use renewable energy to save money or help the environment, or both? Presently, the payback period on installed costs of PV may be 30 years. Do you want day-use systems for part of your energy generation? Do you want to save energy in batteries for use during cloudy weather or nights? Do you want a hybrid system of PV plus wind power or a diesel generator to meet high load demand? Do you want to be totally off the electrical grid? Do you want to be connected to the electrical grid? Find out if your utility company will purchase any excess energy the system generates.

Those who install a PV system before December 2016 are eligible for a 30-percent federal income tax credit. Wyoming offers a Wyoming State Energy Office Residential Photovoltaic Grant Program that will cover half the installation costs up to \$2,000. Contact the Wyoming Business Council at (307) 777-2841 to learn more.

There are advantages, disadvantages, and limitations to PV

systems. Advantages include reliability. Modules typically have a 25-year working life. PV systems are durable, low maintenance, and have no fuel costs. Owners can be on or off the electric grid.

The initial cost of a PV system compared to conventional power may be a disadvantage. Expensive batteries are required to store energy. Replacing old, inefficient appliances with energy efficient appliances such as those listed at [www.energystar.gov](http://www.energystar.gov) may be necessary. Geographic variation in solar radiation due to latitude may result in lower energy efficiency during some months.

## A PV system has efficiency limits

A typical PV panel efficiency rating is around 16 percent. That means the PV panel captures only 16 percent of the sun's energy striking the panel. There is a maximum amount of sunlight power of around 1kW per square meter; thus, a 1-square meter panel puts out 0.16kW. This efficiency level is a result of limitations of the semiconductor materials, shade caused by the metal grid that connects cells, and the relatively narrow spectral range of semiconductor response. The National Renewable Energy Laboratory reported a PV thin-film product had an efficiency rating of 13.2 percent. This rating is higher than earlier versions of thin-film units.

Weather exposure affects PV performance and system maintenance. Solar input varies with locations on earth. The number of hours



of sunlight, the quality, and the angle at which sun strikes the PV panels all affect energy output. Cloud cover and smog will also reduce output.

Local building codes and covenants may regulate PV systems. Check roof engineering and load limits if appropriate.

If you want to hire a designer/contractor, get more than one bid. Ask for references. Get referrals from satisfied solar customers. Ask contractors what their training has been.

Finally, be prepared for regular, periodic maintenance after installation. Prevent new plant growth from shading panels, and regularly check the storage battery charge.

For more information:  
Lawrence Berkeley National Laboratory  
<http://www.lbl.gov/>

"The installed cost of photovoltaics in the U.S. from 1998-2008," Eyan Wiser, et al.  
<http://newscenter.lbl.gov/news-releases/2009/10/21/new-berkeley-lab-report-shows-that-the-installed-cost-of-solar-photovoltaic-systems-in-the-us-fell-in-2008/>

Energy Star  
U.S. Department of Energy  
Environmental Protection Agency  
[www.energystar.gov](http://www.energystar.gov)

Alternative energy information  
[www.uwyo.edu/barnbackyard/info.asp?p=10820](http://www.uwyo.edu/barnbackyard/info.asp?p=10820)

Tax incentive information  
<http://energytaxincentives.org/business/renewables.php>

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## ANATOMY OF A FIRST AID KIT

From the American Red Cross ([www.redcross.org/services/hss/lifeline/fakit.html](http://www.redcross.org/services/hss/lifeline/fakit.html))

To be prepared for emergencies, keep a first aid kit in your home and car and carry a first aid kit with you or know where you can find one. Whether purchased or put together, make sure it has all the items you may need. Include any personal items such as medications and emergency phone numbers or other items your healthcare provider may suggest. Check the kit regularly. Make sure the flashlight batteries work or add a battery-less flashlight. Check expiration dates and replace any used or out-of-date contents. The Red Cross recommends all first aid kits for a family of four include the following:

- 2 absorbent compress dressings (5 x 9 inches)
- 25 adhesive bandages (assorted sizes)
- 1 adhesive cloth tape (10 yards x 1 inch)
- 5 antibiotic ointment packets (approximately 1 gram)
- 5 antiseptic wipe packets
- 2 packets of aspirin (81 mg each)
- 1 blanket (space blanket)
- 1 breathing barrier (with one-way valve)
- 1 instant cold compress
- 2 pair of nonlatex gloves (size: large)
- 2 hydrocortisone ointment packets (approximately 1 gram each)
- Scissors
- 1 roller bandage (3 inches wide)
- 1 roller bandage (4 inches wide)
- 5 sterile gauze pads (3 x 3 inches)
- 5 sterile gauze pads (4 x 4 inches)
- Oral thermometer (non-mercury/nonglass)
- 2 triangular bandages
- Tweezers