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All About Solar Energy

What is a Photovoltaic System?

A photovoltaic (PV) system converts the sun's light energy into electricity by producing direct current (DC) in the PV panels. The DC current may be stored in batteries, or sent to an inverter, which converts the DC current to alternating current (AC) for immediate use or grid distribution.

What do we mean by **photovoltaic**? The word itself helps to explain how photovoltaic (PV) or **solar electric** technologies work. First used in about 1890, the word has two parts: photo, a stem derived from the Greek phos, which means light, and volt, a measurement unit named for Alessandro Volta (1745-1827), a pioneer in the study of electricity. So, photovoltaic could literally be translated as light-electricity.

Photovoltaic cells (PV) are a semiconductor-based technology developed in the 1950's for space satellite power. PV technology uses no fossil fuels, has no moving parts and produces no pollution. For a more detailed definition visit the following link. http://www.fsec.ucf.edu/pvt/pvbasics/

How do we get electricity from the sun?

When certain semi-conducting materials, such as silicon, are exposed to sunlight, they release small amounts of electricity. This process is known as **photoelectric effect**. Which refers to the emission, or ejection, of electrons from the surface of a metal in response to light. It is the basic physical process in which a solar electric or photovoltaic (PV) cell converts sunlight to electricity.

Sunlight is made up of **photons**, or particles of solar energy. Photons contain various amounts of energy, corresponding to the different wavelengths of the solar spectrum. When photons strike a **PV cell**, they may be reflected or absorbed, or they may pass right through. Only the absorbed photons generate electricity. When this happens, the energy of the photon is transferred to an electron in an atom of the PV cell (which is actually a **semiconductor**).

What are the components of a photovoltaic (PV) system?

A PV system is made up of different components. These include the PV modules (groups of PV cells), which are commonly called **PV panels**; multiple **batteries** for backup systems (in case the grid goes down); and an **inverter** for a utility-grid-connected system; **wiring**; and roof-**mounting** hardware. The inverter converts the DC power produced by the PV panels into AC current, which is what the utility provides.

How long do photovoltaic (PV) systems last?

SolSource uses PV panels with a 20 to 25-year limited warranty. Although panels have a useful life expectancy of more than 40 years, it is normal for panels to slowly degrade as they age, causing some decrease in output. This rate of degradation is typically about 0.55 per year.

We have personally seen PV panels more than 50 years old still producing power silently and cleanly just from the sunlight! Inverters come with a five to seven-year warranty, with inexpensive extended warranties. Like other complex electronic components, inverters have a limited life span and likely will need to be repaired or replaced within 10 to 15-years.

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What size system do I need?

This primarily depends on your electrical usage and budget. An average American house uses 700kWh of electricity per month. In Colorado, a 1000Watt (1kW) PV array will produce roughly 120kWhours of AC power per month. To produce 1/2 of the average house's usage, a 3kW system would be required.

Plan on one square foot of roof or ground area for each 10 watts of power, or 100 square feet per kilowatt. For example, a 3-kilowatt system will require approximately 300 sq. ft.

An energy efficient house will always use less electricity and thus require a smaller PV array. This is why SolSource always promotes energy efficiency along with our systems.

Is my home a good location for PV?

A site is most suitable if there is clear and unobstructed access to the sun for at least six hours during the middle of the day. Shading from trees, buildings or other vegetation will compromise the performance of a PV system. Usually, the most ideal site is a large roof area with good southern exposure, although other orientations may also work. If the roof is not suitable, the PV system may be mounted on the ground. Although the cost may be higher, it will be a good tradeoff if there is an increase in the amount of sunlight available for the PV system.

What is net metering?

In a grid-tied PV system, electricity flows through your meter in either direction, depending on the amount of electricity your system is producing and how much electricity you are using. At times, your PV system may produce more electricity than you need, and you will "sell back" this excess power to the utility. At other times, you may need to draw supplemental power from the utility grid. Net metering keeps track of the net difference (on a monthly basis) between the grid-supplied electricity you use and the surplus generated by your PV system. When you generate more power than you use, you'll actually see your electrical meter spin backward!

In Colorado, Xcel will write you a check at the end of the year, if your system has generated more kW's than you have purchased.

How long does it take to install the system?

The installation of a PV system usually takes three to five days, depending on the size and scale of the job. Larger jobs take longer. However, the entire process generally takes two to three months, due to obtaining permits and inspections and submitting your net metering application.

How much does a system cost?

Many factors determine the final cost for a grid-tied PV system, such as: system size, type of mounting system, roof material and pitch, wiring runs and various other installation details. Solar electric systems typically install for $6-7 dollars per watt. However, with available utility rebates and federal and state tax credits, you're out of pocket costs will be almost half that amount.

Ground and pole mounted systems cost more as does battery backup. If the PV system design includes battery backup, you will need about 20% more panels to provide the same amount of energy. In Colorado, the average 3kW system costs about $12,000 (after rebates and tax credits).

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What is the payback for a PV system? Is it cost-effective?

The factors affecting the payback of a PV system includes: system size, future electric rates, available rebates and tax credits, loan amount and financing rate, system output and performance, among others, making it hard to determine the exact payback.

If you believe that electric rates will continue to increase, purchasing a PV system becomes a very smart response to hedging against energy inflation. Locking in your energy rates today makes great sense for the future. If you finance your system through a second mortgage, your monthly payment will help increase the equity in your home. Plus, interest paid on your loan is tax deductible, allowing you to pay for the system with pre-income rather than post-income tax dollars. And if you sell your property, all of most of the installation cost will be recovered, since a PV system increases your home's value.

Is any maintenance required?

A solar electric system requires very little maintenance. The system will perform better if the panels are kept clear of snow and dust. The rule of thumb is - if it rains once a month, that's sufficient to clean the PV panels, and maintain optimal performance. All systems installed by SolSource carry a 10-year parts and labor warranty.

How do I get my power at night?

Since PV modules only produce electricity when the sun is shining, during the evening you will purchase from your utility. During the day, your PV system will be offsetting all or a portion of the electricity your home or building requires. If your system produces more power than your home requires, your utility meter will spin backwards, producing a credit with your electrical provider. Your grid-tied PV system will automatically shut down (for safety reasons) in the event of a power outage.

In a grid-tied, uninterruptible power supply (UPS) system, a bank of batteries is charged during the day. During a power outage, your critical electrical needs (refrigerator, furnace, well pump, computer) are meet by the power stored in the batteries.

Does the PV array have to go on the roof?

No, while the roof is the most common place to mount a PV array, SolSource can design a ground or pole mounted system. You must have ample unobstructed area. For examples please see the following pictures:

What other issues may need to be considered?

It is a good idea to find out about:

1. Permit requirements
2. The condition of your roof. Does it require repair before your system is installed?
3. Will the PV system be shaded (thus reducing its output) from trees, vents or other structures on or near your roof?
4. Do you have sufficient space on your roof to accommodate a PV system?

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How do I get started?

If you think a solar energy system is right for you, send us an e-mail or give us a call at **303.297.1874**.

We'll ask you some questions about your objectives, your house/building and your budget. We'll then set up a site visit and help you on the path towards energy independence!