General Solar FAQs:

What is solar power?
Solar power uses the suns energy and converts it into an electric current.

What is a solar cell ?
A solar cell, also called a photovoltaic (PV) cell, is the smallest element that converts light into electrical energy(DC voltage and current). Each cell is made of silicon like a computer chip. The silicon is treated so that it generates a flow of electricity when light shines on it.

Are solar cells a new technology?
Modern solar cells with practical efficiency were invented in the early 1950s, and have been used to power satellites since 1959. They became popular for terrestrial applications in the mid-1970s, mostly for remote telecommunications, navigational aids and other rugged, remote industrial uses including microwave, TV, radio and cellular repeater stations. They have been powering urban applications such as roadside emergency telephones and traffic sign boards since the mid-1980s. With prices dropping steadily, they are now becoming more affordable for urban homes and businesses.

What is a solar panel?
A solar panel or panel, consists of solar cells, a frame and a junction box which allows the current produced by the solar cells to be directed to a battery.

Do solar cells store energy?
No. Solar cells just convert sunlight into an electric current, batteries are used to store the energy created by the solar cells on the solar panel.

How well do solar panels withstand, and work in, inclement weather?
In cloudy weather, solar panels work, although they produce less electricity than on a sunny day. Under a light overcast, the solar panels might produce about half as much as under full sun, ranging down to as little as five to ten percent under a dark overcast day. If the solar panels become covered with snow, they stop producing power, but snow generally melts quickly when the sun strikes the panel; if you brush the snow off, they resume operation immediately. Our solar panels can withstand one inch (2.5 cm) hailstones at 50 mph (80.5 kph).

What are the different types of solar technologies?
The are several types of solar technologies some of these are:
Photovoltaics: Photovoltaic solar cells, which directly convert sunlight into electricity, are made of semiconductor materials. This can include very simple cells that power calculators and watches, and complex systems that can light houses.

Passive solar heating: Buildings designed for passive solar and daylighting combine building materials that absorb and slowly release the sun's heat with design features such as large south-facing windows. No mechanical means are employed.

Solar hot water and space heating and cooling: Solar hot water heaters use the sun to heat either water or a heat-transfer fluid in collectors.

Concentrating solar power, this technology uses reflective materials such as mirrors to concentrate the sun's energy and convert it into electricity.

What does photovoltaic (PV) mean?

PV means the direct conversion of light into electricity. Photovoltaic cells convert sunlight directly into electricity. When sunlight strikes a PV cell, electrons are dislodged, creating an electrical current.

Photovoltaic cells power many of the small calculators and wrist watches in use every day. More complex systems provide electricity to pump water, power communications equipment, light homes, and run appliances. Beyond the utility power line, PV is often the lowest-cost means to provide electricity, and almost always simplest and cleanest to operate.

Photovoltaics are producing electricity for critical loads from the polar ice caps to the tropics to satellites in outer space. There is a strong market today in developing countries to provide rural electrification with solar panels, which replace kerosene lamps, batteries, and wood fires at a far lower cost than the central station power plants.

Photovoltaics are also making inroads as supplementary power for utility customers already served by the grid. Currently costly compared to most conventional choices for grid power, Photovoltaics is still a very small part of the energy make-up of any country. However, more and more individuals, companies, and communities choose PV for reasons other than cost: because of a desire to develop a clean, sustainable energy source, interest in a clean back-up power source, a need for placing power generation right at the source with no fuel, noise or moving parts; and an attraction to a power technology that can be built right into building roofs, facades, canopies and windows.

What is a PV array or Solar array?

An interconnected system of PV panels that function as a single electricity-producing unit. The panels are assembled as a discrete structure, with common support or mounting. In smaller systems, an array can consist of a single panel. In simpler terms a PV array is multiple solar panels being used together to produce electricity.

What is a PV system?

A PV system is a complete set of components for converting sunlight into electricity by the photovoltaic process, including the array and the balance of system components.

What is PV conversion efficiency?

The ratio of the electric power produced by a PV device to the power of the sunlight shining on the device.

Are solar electric systems safe?

Yes. Solar cells are mostly silicon, the primary component of sand. There is no exhaust and no toxic materials to leak out of the system. The electricity coming through the inverter is just like the electricity coming from household wall sockets; you should use the same care you would with utility power. All components are approved for utility interconnection and are installed according to standard construction practices.

Are solar power systems good for the environment?

Yes! Energy created through our solar electric system produces no pollutants.

How do solar cells generate electricity?

Solar Panels, also known as Photovoltaics or PV for short can be thought of as a direct current (DC) generator powered by the sun. When light photons of sufficient energy strike a solar cell, they knock electrons free in the structure forcing them through an external circuit (battery or direct DC load), and then returning them to the other side of the solar cell to start the process all over again.

Will solar work in my location?
Solar is universal and will work virtually anywhere, however some locations are better than others are. Irradiance is a measure of the sun's power available at the surface of the earth and it averages about 1000 watts per square meter. Obviously different parts of the world receive more sunlight from others, so they will have more "full sun hours" per day.

What is the difference between amorphous cells and polycrystalline cells?
Amorphous solar panels contain no cells per se but are created rather through a deposition process which actually forms the silicon material directly on the glass substrate. To understand this a bit clearer, think of it as spraying the silicon onto the glass in very thin layers. This film which gives amorphous panels the "thin-film" nick name, is laser patterned which interconnects instead of physical connecting tabs which eliminates a mechanical connection that can break down and fail. The amount of silicon used in this process produces a film, which is often up to 100 times thinner than that of a polycrystalline cell. Furthermore, amorphous type solar cells are better at generating electricity in all lighting conditions.

What are Monocrystalline Solar cells?
Monocrystalline silicon is a material consisting of thin wafers cut from one silicon crystal or ingot. The crystal has grown in only one direction.

What are Polycrystalline Solar cells?
Polycrystalline silicon is a material consisting of thin wafers cut for a silicon crystal which has grown in several directions.

What is CIGS solar technology?
Sunforce Products ProSeries Solar Panels are high efficiency photovoltaic panels made using the latest Copper Indium Gallium diSelenide (“CIGS”)process, which represents the latest advances in thin film solar technology.
The solar panels provide for consistent power and do not degrade over time when exposed to sunlight. Furthermore, studies have shown that “CIGS” material, actually yields more energy per kW installed, due to better performance in low light.
Sunforce ProSeries “CIGS” solar panels incorporate “Multijunction” Technology to allow a greater absorption of solar energy, leading to increased overall efficiency.

What types of batteries can I recharge?
You can recharge all types of rechargeable 12 volt batteries including lead-acid automotive batteries, deep cycle (traction type) batteries, gel-cell batteries, and heavy-duty (stationary type) batteries. When using the Solar Panel to run appliances on a regular basis, we recommend the use of deep cycle batteries which are designed to withstand frequent charge and discharge cycles.

Will the Solar Panel drain my battery at night?
Once the solar charge controller is installed there is no danger of reverse current, so you may leave your panel installed overnight. Our solar panels are equipped with a blocking diode to prevent reverse current from the battery. The blocking diode does not prevent overcharging of the battery, for overcharge protection please use a solar charge controller.

Can the Solar Panels overcharge my battery?
Yes, but only if used without the charge controller. That is why it is important to use a solar charge controller. Always use a solar charge controller with solar arrays of 15 watts or higher. Please see our Support Section for help in choosing the correct charge controller for your solar array.

Can I run my 110 volt appliances with my solar power system?

Yes. You can run your 110 volt appliances with an inverter, which will attach to your battery to change the battery's 12 volt (DC) energy into 110 volt (AC) or 220 volt (AC).

Can my Solar panel be left outdoors without a protective covering?

All Sunforce Products solar panels are weather proofed except for the Solar Battery Maintainer. All other Sunforce Products Solar Panels may be left outside without protective covering. However, it is a good idea to wipe them off from time to time to minimize lowered efficiency due to residue build up on the solar panel.

Do I have to disconnect the panels from the battery when I drive my RV or while I am recharging my battery by other means?

No, solar panels are designed to be permanently connected to the battery. There is no need to disconnect them while driving a RV for example, or when charging the batteries by other means such as AC chargers, or a vehicle's generator or alternator.

The LED on the panel does not light up. Should I be concerned?

The LED indicates that your unit is receiving daylight exposure. If it is not lit, it may mean that you are not exposing the unit to enough daylight. Please position the solar panel to maximize its exposure to the sun. If this does not trigger the LED to work, it is possible that the LED is burnt out. The LED may have a more limited life span than the panel. This in no way reflects on or affects the performance of the solar panel. If the LED light is not blinking and you feel you have sufficient daylight, test the solar panel with a solar voltage tester or a multimeter.

Do PV systems work better in hot or cold weather?

A PV panel's power output is reduced at high temperatures, but the lifetime of the PV panel (estimated to be at least 20, maybe 30 years) is not affected by normal (outdoor) heat. The duration of sunlight and the intensity of the sunlight has a major effect on the output of a PV panel, and the increase in temperature has a lesser effect on the output. Therefore, a PV panel installed in Arizona will put out much more energy over a year than an exact same panel installed in Boston, Massachusetts. The Boston panel does not get as hot, and would put out slightly more power when at peak (around noon time) conditions, but the panel in Arizona will get about 70 percent more sunlight energy in, and will only lose about 20 to 30 percent due to the increase in operating temperature, overall a gain of 40 to 50 percent. A general "rule of thumb" for crystalline silicon PV panel (the most common type to date) is that the efficiency (and, therefore, the power output) is reduced about 0.5 percent for every degree C increase in temperature. PV panels are usually rated at panel temperatures of 25°C (77°F) and seem to run about 20°C over the air temperature. So on your hot day of 100°F, the panel will be 120°F or 50°C, so it will have its power reduced by 12.5 percent. The design of a PV system usually takes into consideration the need to allow some "convective cooling" for the PV panels, that is, some way to passively dissipate the heat generated from the panel and minimize the panel temperature to increase the performance. The usual method is to leave the back open and allow some air flow around the panels.

What types of materials are used in making a photovoltaic cell?

The most widely used material for PV cells is silicon, a semiconductor. The silicon is "doped" (that is, it has a certain amount of impurities placed into the silicon crystal) with either boron or phosphorus to give it the properties needed to be a PV cell and give up electrons when exposed to light. The photons of light (photons are actually small particles of light) "knock" the electrons out of the outside band of the silicon atom and that is what creates the PV effect.

What are some of the possible substances that give off an electron when exposed to light?

The most common is silicon (silicon solar cells start out as simple beach sand and the sand is refined to be very, very pure). Other materials are selenium, gallium-arsenide, copper and selenium, and cadmium telluride.

Would one of the substances in the solar cell give off an electron easier if it were in the liquid state (because the molecules in a liquid have more energy)?

All of the commonly used PV materials are solids at room or normal earth temperatures and all work better if they are cold rather than hot (see question above). None of the common PV materials are liquid at normal conditions and they would not be as efficient at converting light to electricity when they were heated to a liquid state due to the higher energy levels. The higher energy levels are detrimental to PV efficiency because the molecules are moving around more and the photons cannot "hit" the electrons as easily and they are recombined more at higher energy levels.

What is the efficiency of current PV cells?

Current PV cells range from about eight percent (for a thin layer cell made of amorphous silicon) to 18 percent (for a very good single crystal silicon cell). Some very special cells have been produced for research purposes that are in the high 20s. More typical single crystal silicon cells usually average about 14 percent, thereby giving panel efficiencies (sunlight to DC energy) of 11 to 12 percent.

If PV arrays get dirty, won't they deliver less power?

The impact of soiling on PV output is a frequently mentioned and widely misunderstood issue. Designers commonly estimate that, in the absence of rigorous manual cleaning, soiling will reduce annual generation by one to four percent. Bird droppings, pollution, and dust from traffic or farming activities accumulate rapidly, however, and can reduce output by as much as 20 percent over the course of a dry summer. Other variables -- such as surface material and orientation -- are also believed to influence soiling. To get a better idea of how soiling affects PV, PVUSA is conducting a simple side-by-side test of two identical panels installed on a fixed-tilt rooftop. One panel is cleaned three times a week while the other is left to the forces of nature. The short-circuit current of the two panels has been monitored for nearly two years now. The difference in appearance is remarkable [with one heavily covered with dirt]. PVUSA has determined that annualized soiling losses can be expected to exceed seven percent during a normal rainfall year such as 1999, but only four percent during a wet year such as 1998, when El Niño weather resulted in twice the normal amount of rainfall in the Sacramento [California, U.S.A.] area [where the test is being held]. PVUSA estimates that, during drought years, the annual soiling losses may exceed 10 percent. Certainly, PVUSA s Davis [California] site represents a harsh soiling environment. They receive little or no rain from April to November and local agricultural activities can create quite a bit of dust. However, these results suggest that PV systems in the area -- and likely others -- would benefit from array cleaning. Now that PVUSA has quantified the effect of soiling and the proportional energy losses, a metric will be developed to determine when to clean the array. They also will investigate different ways of cleaning panels in search of the safest, most beneficial, and most cost-effective method. Excerpted from "How Clean is My Array? The Real Dirt on Soiling," PVUSA Project Update, Third Quarter 1999. For further information, contact pvusa@endecon.com.

How long does it take to charge a dead battery?

This depends on many factors, wattage of the solar panel, reserve of the battery and of course the amount of sun available. Please see our Solar Calculator for help choosing how many solar panels you might need for your project.

Can I extend the wire?

Yes, for best results please consult a DC wire sizing chart to avoid power loss.

How do I get a 36V system with my solar panels, to charge 6 x 6V Batteries?

You can’t, our systems only works with 12V systems.

How can I change the voltage of a 12V system (DC) into one of 110V or 220V?

A 110V inverter can be attached to your 12V deep cycle battery and 110V devices may be plugged into your solar system. North American electrical appliances are 110-120V whereas European electrical appliances are 220V. Inverters can be purchased for 110V or 220 V systems.

What is amperage, i.e. amp?
It is a measure of the current of electricity. Amps = Watts divided by voltage.

Does the solar panel have to be directly in the sunlight?
No, but it will create more current if it is. Also, it is ideal to have the whole panel in the sunlight otherwise the panel can get “hot spots”. These “hot spots” will create invariable electricity production.

Is there such a meter that will tell you how much electricity you are giving to the main grid in your area?
Yes, it is called a Grid Tie; this can be acquired by calling your local electric company.

How do I build a solar system?
There are many factors that come into play when installing a solar system.

First, in order to know how large a system you have to purchase, you must know how much energy you are consuming. This can be found on the bill statement of your electric company. If you are not attached to an electric grid and are in an isolated area, you may simply add up all power consumption from individual items that will be consuming power. i.e.: If you have a fridge and four 40W bulbs within your system, find power consumption for each item and add them up and this will give you your total power consumption.

Once the power consumption issue has been solved you may proceed in purchasing your system. Needed, are solar panels to fulfill your energy needs. Our company presently stocks panels from as small as 1W to as large as 170W.Multiple solar panels can be wired in parallel to increase the wattage, or power needed.

The next step in building your solar system is to add solar charge controllers. Sunforce Products has various models of charge controllers for different systems. The total wattage of the solar array or solar panels wired together is needed in order to determine the size of the solar charge controller. Keep in mind that if your system constitutes less than 10 watts there is no need for a charge controller. The purpose of the charge controller is to keep the battery from overcharging and discharging during the night. The way to connect the charge controller to your system is to take the respective wires of the solar panels and connect them to the allocated terminals on the charge controller, positive to positive and negative to negative. Multiple solar panels can be connected together by simply connecting them in parallel, (all of their positives wires together and connecting all of their negatives wires together), and connecting these connections to the charge controller.

Now that the connection has been made to the solar panels, hook up the wires to the battery terminals of the charge controller and plug them to your batteries. The best batteries for this application are 12V deep cycle batteries. These are meant for long charging and discharging periods.

The solar system is now ready for use. Keep in mind that this is a 12V system. In order to transfer it to a 110V system, simply add an inverter and attach it to your battery. In order to transfer it to a 220V system, there are also 220V inverters.

What are the rates of solar panels?
Everything is rated hourly.

My Solar Chargers are not charging my batteries, what do I do?
To test whether the panel is charging the battery is to test the voltage. Use a voltmeter and test the open circuit voltage. The open circuit voltage is the voltage that is read when the solar panel isn't connected to any device. Appropriate open circuit voltages are labeled in the instructions of each panel. Voltage of the solar panel can also be tested when connected to the battery. All tests should be done under full lighting conditions.

How much does a typical house consume in a year?
The average house consumes 4000kWh per year. 1000 Watts is equivalent to 1 kilowatt.

How do I mount my Solar Panels?

The simplest mount is a ground based frame angled toward the sun. A step up is a raised mount that has an adjustable angle to allow for the changing angle of the sun in the sky through-out the year. The most efficient (and most expensive) is a tracking mount that follows the sun in its arc across the sky each day.

What is meant by Flooded batteries?

Flooded batteries have those little caps on top and you must add water (distilled) to them from time to time as the charging process boils off some of the water as hydrogen gas. They should be installed in vented boxes and not used indoors or near spark or flame.

What is a sealed battery?

Not to be confused with maintenance free, a sealed battery has no service caps and water is never added. They also do not out gas during the charging process and are safe to use indoors. This usually means that the temperature of the battery will be more constant which translates into more efficient operation.