



# A Beginner's Guide to Solar Panels

## Introduction

Global warming is a huge problem which will significantly affect every country in the world. Many people all over the world are trying to do whatever they can to help combat the effects of global warming. One of the ways that people can fight global warming is to reduce their dependence on non-renewable energy sources like oil and petroleum based products. There has been a vast increase in the interest of businesses and everyday people in finding ways to live in a more environmentally responsible way and to find alternate fuel sources.

It's not always easy to find ways to be more environmentally responsible and still meet all the obligations of everyday life. For example, many people would like the chance to ride a bike to work everyday or walk instead of having to drive a car but for many of those people that's just not a feasible option.

Taking public transportation is a better alternative than driving to work everyday but that isn't much in your control. Whether or not you can take public transportation really depends on where you live and how much of a public transportation system there is in place in that city. It's not unusual for a large city to have a public transportation system that doesn't function well in reaching its population or a smaller city not to have any public transportation available at all.

So what are some options that are out there for people who want to live in a more environmentally-friendly way but still have to deal with certain day-to-day realities that don't always allow them to make the choices they'd like to make? One of them is using solar energy to help heat and power your home. Solar energy is a completely renewable energy source that will save you money on your heating and electricity costs as well as save environmental resources.

In the past using solar energy was not really something that most people could use at home because the technology was still being developed. In recent years the investment by government and industry into developing solar power technology has made using solar power much more affordable and feasible. Today homeowners and apartment and commercial building developers are able to use solar energy and help the environment while saving money.

Using solar energy as a main power source is still relatively new in the United States but other countries have been relying on solar power for a large amount of their energy needs for years. These countries have proven that with the right equipment and technology it is possible to reduce dependence on fossil fuels and non-renewable energy sources. Because solar energy produces no greenhouse gases, using solar power helps the environment.

## What is renewable energy?

There is a lot of focus on finding ways to use renewable energy to fill the vast power needs of the world population. What exactly is renewable energy? Renewable energy means harnessing the forces of the wind, the sun, water, geothermal, and other natural occurring forces to create energy that can be used for electricity and heat.

Unlike fossil fuels which are also natural but are only available in limited supply. Renewable energy sources can be used over and over again without depleting them. There are five main sources of renewable energy that humans can use:

1. Bio energy – Bio energy is created from plants or grains that can be replanted and replenished. Ethanol is an example of using bio energy. Ethanol is a fuel that is a hybrid of petroleum and an alcohol-based fuel that is made primarily from corn in most of the United States, although some other countries, like Brazil, make ethanol using sugar cane instead of corn. Ethanol is widely used in other countries and is becoming more popular in the United States.

Many companies and scientific labs are experimenting with different bio fuels to find a bio fuel that works with already existing vehicles to help reduce dependence on petroleum. Hybrid vehicles that run on a combination of petroleum based fuel and bio fuels are becoming more and more popular. Some vehicles that run on diesel fuel are being converted to run on bio-diesel which is a fuel made from used vegetable oil that is discarded by restaurants and food plants.

2. Hydro power – Hydro power is using the power of flowing water to create electricity. Hydro power is one of the oldest continually used forms of creating energy and was extremely popular before it became common to use fossil fuels. For hundreds of years rushing water was used to create energy that would operate a grain mill and grind corn and wheat, power steam engines, and provide energy for other common tasks. The first known use of hydro power to provide electricity was in 1880, and hydro power has been used to generate electricity every since.

Hydro power is still used today. About 7% of the electricity used in the United States each year comes from hydro electric plants. Because it's necessary for a large hydro electric plant to be located directly on a large body of water in order to have enough water to generate the kind of power that is needed to make electricity hydro electric power plants are not widespread. More than half of the many hydro power plants in the United States are located in only three states: Oregon, California, and Washington.

Hydro power is often considered to be the ideal form of renewable energy because it's practically free, it creates no pollutants that harm the environment, and it has almost no waste products of any kind. The drawback is that hydro power can only be located in a small number of areas with the right natural features. Plus, the large dams needed to harness hydro power can dramatically alter the landscape and affect wildlife.

3. Geothermal power - Geothermal power comes from using the natural heat from deep inside the earth. The core of the Earth generates a lot of heat and water that is heated deep within the Earth and released to the surface through hot springs and geysers. Even volcanoes can be used to heat buildings and homes as well to provide electricity.

The most common use of geothermal power is direct heating. Direct geothermal heating consists of piping hot water from below the surface of the Earth directly into buildings or homes to heat the buildings. Iceland gets up to 95% of their heat from geothermal direct heating. The island nation sits on the world's most easily accessible source of heat energy from volcanic magma close to the Earth's surface.

The United States is the biggest user of geothermal energy for electricity in the world but still less than 1% of all the electricity produced in the United States is generated from geothermal energy. There are about 50 geothermal electricity plants in the United States, mostly in California and Nevada. Since the easiest place to access the water heated within the earth is along fault lines and on the edges of tectonic plates it's not surprising that those two states have the most geothermal energy plants. Geothermal energy produces no pollution or greenhouse gases but can be expensive to utilize and can only be used in a small number of areas that have the proper geology.

4. Wind - Wind energy was probably the first type of natural, renewable energy that was used by people to provide power. Wind energy has no pollutants or contaminants and is great for the environment, but sometimes it can be hard to harness enough wind to generate significant energy.

Wind energy is mainly used locally, supplying electricity on and around wind farms. The United States is third on the list of countries that have the most capacity to produce wind energy yet wind energy is not yet widely used in the United States. In the past this was mostly because building the machines, called wind turbines, which are used to harness wind energy, was expensive and consumed a lot of natural resources. Since 2005 there have been some great technological advances that have made it much more cost-effective to build turbines so the use of wind energy is beginning to grow in the United States.

One of the biggest problems of producing enough wind energy to meet the huge electricity demands of the people in the United States is the weather. Since wind can't be grown like the crops that are used for bio energy, and wind is not as constant as the water used to create hydro or geothermal energy there is a limit to how much energy wind can produce. The variability of the wind is also a crucial factor. If there isn't much wind on a particular day there might be very little or no electricity generated that day. Another drawback to wind energy is that a large number of very large wind turbines (they can run up to 25 stories tall) are needed to create a significant amount of energy.

Wind energy is a good source of renewable energy under certain conditions but in the long run wind energy is not going to be the best source of renewable energy for countries to use.

5. Solar energy – Solar energy is collecting and then using the energy generated by the sun for things like electricity and heating. Solar energy is being used more and more by businesses and homeowners as a way to fight rising electricity bills and also to live in a more environmentally friendly way.

One of the first recorded uses of solar energy was in the 1830's when a British explorer in Africa built a box to collect the energy from the sun's rays and used it to cook his food. Today solar energy is used mainly to create heat and to create electricity.

There are two ways to generate electricity from solar energy. The first is using the Photovoltaic method. This method uses a collection of cells made of certain materials to grab the sun's energy and directly convert it to electricity. Since the sun's rays are diffuse it takes a large number of these photovoltaic cells working together to provide any real power.

The second way is using solar power plants. These huge plants use sunlight indirectly to create electricity. In simple terms the sunlight heats water which produces steam and the steam powers a generator that creates electricity. There are 15 large solar power plants in the United States. 10 are in California, and 5 are in Arizona.

Solar energy is totally renewable and has no measurable impact on the environment which is why it's the renewable energy system of choice for many environmentally conscious people. However there are a few drawbacks to using solar energy. One disadvantage of using solar energy is that because the energy created by the sun is so diffuse it takes a lot of sunlight to generate power. This means that solar plants have to have a large surface area.

Another disadvantage of solar energy is that the amount of the sun's energy that reaches the solar cells depends on things like the amount of cloud cover, the temperature, the time of day and other factors that can't be controlled. Scientists are trying to develop ways of using solar energy to generate large amounts of power, similar to central power plants burning fossil fuels today. Page 8

Most experts agree that the best way to use solar energy for electricity and heating is for individual homeowners and building owners to use solar panels to generate heat and electricity for their own buildings.

## Why is it so Important to Use Renewable Energy?

Scientists have been searching for reliable sources of renewable energy for decades because the United States is very dependent on fossil fuels for energy. The United States has some fossil fuel resources but those are getting used up at alarming rate, and national reserves and parks are at risk of being invaded by developers who want to come in and drill for oil or natural gas. Allowing the development of these protected areas would ruin the fragile ecosystems in those areas and could cause a lot of damage to local wildlife.

The United States also imports a lot of fossil fuels which is very expensive, and is getting more expensive by the year. Gas and electricity prices are rising and many people are being forced to choose between buying food or medicine and buying gas for their cars or electricity for their homes.

For many years fossil fuels were cheap and plentiful. People used oil and coal without any thought about what would happen when those natural resources were used up. Now, the natural resources that the United States has are disappearing everyday and foreign countries are charging more and more to buy their fossil fuels.

Fossil fuels are non-renewable and cause a lot of environmental damage. The air quality in some cities is so bad as a result of all the fossil fuels that are being used that people are developing health problems like asthma or even chronic obstructive pulmonary disease (COPD) and emphysema just from breathing in the polluted city air.

The environment is also changing because of the massive amount of fossil fuels and non-renewable energy being used all over the world. Scientists say that global warming is one of the results of the overuse of non-renewable energy by most of the industrialized countries in the world. Global warming is causing a lot of serious environmental problems that could lead to a lot of destruction all over the world. Weather patterns are changing, glaciers are melting, and many countries are facing more natural disasters than ever before because of global warming.

Even though many experts say that global warming can't be completely stopped at this point switching over to using as much renewable energy as possible could slow the progress of global warming or even help heal some of the damage that has global warming has caused to the planet.

## **The Advantages of Using Renewable Energy**

Finding reliable sources of renewable energy is important in order to help slow the effects of global warming and to reduce the need for fossil fuels. There are also other advantages to using renewable energy to replace the burning of fossil fuels. Some of the biggest advantages of using renewable energy are:

Renewable energy will never be depleted – No matter how much energy is needed by people all over the world renewable energy sources will never run out and can continue to make electricity and heat as long as there are people that need them.

Renewable energy helps the environment – This chiefly comes from producing fewer greenhouse gases that contribute to global warming. In addition to slowing down the effects of global warming using renewable energy sources also helps preserve ecosystems that would be destroyed to develop the fossil fuels found in the land. When there are fewer pollutants in the air the plants and trees that make oxygen will be healthier and will put out more oxygen which will make people healthier.

Renewable energy is safer than fossil fuel – Fossil fuels used to create heat and electricity and as fuel for vehicles creates toxic chemicals that are released into the air and lead to bad air quality and acid rain. Everything that is alive is affected by that kind of pollution including us humans. Renewable energy sources greatly reduce or even eliminate pollution of the air and water. With less pollution in the air and water people will be healthier and won't be at risk of health problems caused by pollution like asthma and other respiratory problems.

Renewable energy sources create jobs and industry – Because renewable energy sources require specialized equipment and lots of research the business of creating renewable energy sources that are accessible to lots of people means that there will be a lot of new businesses starting and a lot of new jobs for people.

Renewable energy means cheaper energy – When countries depend on renewable energy sources instead of foreign fossil fuels the cost of renewable energy will go down making electricity and heat more affordable for everyday people. Renewable energy also offers a chance for increased economic development. This is especially true for people who in the past have been struggling to make a living like farmers that grow grain and plants that can be used for bio energy.

## **What are Solar Panels?**

Solar panels are flat collections of solar cells that are used to catch the Sun's energy and use it to create electricity and heat. Because the sun's energy is so spread out it takes a collection of solar cells to generate enough energy to make electricity or heat. Solar panels come in different sizes and shapes so that they can be used on a variety of different types of buildings but no matter what shape or size they are the basic design of a solar panel is the same.

## How do solar cells work?

Solar cells are wafers made of a semi-conductive material, usually silicon, combined with rarer elements such as phosphorus and boron. The silicon is what grabs the energy from the sun and traps it to be used for electricity while the phosphorus and the boron help excite the molecules and intensify the energy that is coming into the cell. When the sun's rays hit the silicon and are channeled through the cell the molecules excite and travel through an attached electrical circuit, creating electricity.

Solar panels convert anywhere from about 14% to about 22% of the sun's energy that hits the panel into electricity. That doesn't seem like a lot of electricity produced but the amount of electricity that a solar panel can generate also depends on where the panel is positioned and how much direct sun it gets. When there is no sun or the panel isn't in the directly sunlight it gets little or no sun and will produce little or no electricity. The low efficiency of solar cells is a problem to their large-scale use. It takes many large solar panels of solar cells to provide enough electricity to power a house or a building.

Solar panels produce electricity that can be used for lighting but solar panel energy can also be used to heat a home or building. A solar thermal heating system consists of solar panels that are arranged in a specific spot where the solar panel energy is used to heat a tank of water. The hot water runs under the floors of the house, heating them, and then the water is piped back to the tank to be heated again.

Thermal solar heating systems work very well and are a cost effective and environmentally friendly alternative to expensive gas or electric heating systems. Solar thermal energy is often used quite a bit by people that have pools and outdoor hot tubs to heat the water they use. It's a lot less expensive to heat a large pool or a hot tub with thermal solar energy than it is to use fossil fuel heaters that can cost a fortune.

## What are SOLAR PHOTOVOLTAIC Systems?

Solar photovoltaic systems, or PVsystems, are the components in a solar cell that actually grab the energy from the sun and turn it into energy. PVsystems are the fastest growing area of technology in the world and production of solar cells that use PVsystems has been consistently doubling about every two years. Mainly this is due to rising interest solar energy and the desire of more people to buy solar panels to create their own electricity and heat for their homes. The demand for improved solar power technology encourages governments and businesses to invest time and money into improving the technology and making it more cost efficient.

Some governments around the world, especially in Europe, are giving financial incentives both to companies that are working on developing PV systems and making them more efficient and less costly to the average consumer and also to the consumers that buy them. Because PVsolar cells are still relatively new when it comes to solar energy the cost of a solar panel containing PVcells is still fairly high in most places. Also, one solar panel is not usually enough to power an entire home which makes using solar PVsystems even more costly for the average homeowner.



The good news is that more and more homes are being built with PV systems already installed which makes it easier and less costly for consumers to buy environmentally friendly homes that run on solar power. Businesses that want to operate factories more cost effectively and in a more environmentally friendly way while collecting some nice government incentives are also installing solar PV energy systems. Germany is currently the biggest market for solar PV systems with the United States, Australia and Spain not far behind.

Solar PV systems are being used successfully around the world to power devices like roadside signs, traffic lights, emergency phones, and other stand alone devices that might be difficult to power using traditional electricity or batteries. Solar PV energy has proved enormously successful at powering these devices. Using solar PV systems in these types of devices and in other everyday machines like parking meters has saved many cities and towns a lot of money because they don't need to send out regular maintenance crews to make sure that these things are still running properly.

Critics of solar PV systems say that while the solar energy produced by the PV cells doesn't have any harmful effects to the environment the production of these cells does result in some pollution. Advocates of the solar PV cells say that they are working on developing a type of PV energy cell the production of which won't produce any pollution. While the production of the cells does create some pollution it doesn't create as much pollution as other types of materials do when manufactured or used to create energy.

## **The History of Solar Panels**

Photovoltaic power was first discovered by a French scientist, Antoine Becquerel, in 1839. Many scientists that followed experimented with solar power and tried to build a device that would capture the sun's energy and redirect it but they were not able to find a way to make a working PV cell. The solar cell was first successfully made by the scientist, Charles Fritts, in 1882. Since they didn't have the same types of materials that we have today the first working solar cell was made of thin sheets of Selenium, a mineral, that were then coated with gold.

Even though the use of solar panels for generating electricity and heat seems like a relatively new development it's actually been widely used to generate power since the early 1900's. Photos from that period show a series of parabola shaped "sun catchers" that would harness the power of the sun and focus it on water tanks. Once the water was heated it made steam which was used to power farm machinery. The solar heated water created enough steam to power 55 horsepower machinery which was cutting edge at the time.

Then, in the middle of the Industrial Revolution, businesses found that they could use the sun's energy to heat water which created steam to power the machines in the factories. At that time solar energy was considered the wave of the future and a lot of companies began developing better ways to use the sun's energy until after WWI when fossil fuels became more attractive to companies and farm owners to run their machinery.

The first working silicon solar cell didn't come along until 1941 when an employee at a Bell laboratory, Russell Ohl, patented his design for a silicon based PV cell. In 1954, Bell labs mass produced the first crystal silicon solar cell. The Bell PVcell converted 4% of the sun's energy into electricity a rate that was considered the cutting edge in energy technology.

Scientists continued to reinvent and rework the design of the original silicon PVcell and were eventually able to produce a solar cell that was capable of putting out a 20% return electricity rate. In the 1980's solar cell technology was being used almost exclusively for space travel.

The use of solar power in space is a natural given that spacecraft can't burn fossil fuels in the vacuum of space and in space the rays of the sun are not reduced by the Earth's atmosphere and clouds. In the late 1990's as awareness grew in the science community about the effects of global warming and the need for renewable energy sources scientists continued to refine the silicon PV cell until by early 2000 they were able to make a solar cell with 24% electricity return.

In just 7 years scientists were again able to increase the electricity return of the silicon solar cell using space age materials. By 2007, modern silicon PVsolar cells were operating with a 28% electricity return. As scientists continue to make better solar cells it will become more common and more cost effective for homeowners to use solar cells and solar panels to power their homes.

## Types of Solar Panels

Today there are essentially four different types of solar panels that you can purchase easily and use if you want to install solar panels on your home to generate electricity or heat your home. They are Monocrystalline Silicon Panels, Polycrystalline Silicon Panels, String Ribbon Silicon Panels, and Amorphous Silicon Panels.

**Monocrystalline Silicon Panels** - Monocrystalline (or single-crystal) silicon solar panels have a return electricity rate of anywhere from 14% to 18%. These panels are made from one continuous sheet of silicon that has pieces of metal nailed to the edges to increase the conductivity and to excite the electrons.

Monocrystalline panels are more expensive than some of the other types of solar panels that you can buy but they are also more effective, so in the long run you're better off buying these panels if you can afford the up front cost.

**Polycrystalline Silicon Panels** - Polycrystalline (or multi-crystal) silicon panes have an electricity return rate of about 12%-14% so they are less efficient than monocrystalline silicon solar panels. These panels are made up of lots of individual PVcells that have metal conducting materials nailed to the sides that will help excite the electrons and also connect the cells together.

Polycrystalline silicon panels are the cheapest solar panels to produce so they are usually the cheapest for consumers to buy. The maintenance costs of polycrystalline silicon panels is lower than the maintenance cost of monocrystalline solar panels because if one of the cells on a polycrystalline panel is damaged you can have the individual cell replaced without having to replace the entire panel.

String Ribbon Silicon Panels – String ribbon silicon panels are made in a similar way to the polycrystalline silicon panels and have about the same electricity return rate. The difference between string ribbon silicon panels and polycrystalline silicon panels is that the PVcells in a string ribbon panel are made of strips of silicon attached to metal bars that connect the strips to form a cell. Using strips of silicon to form the cell instead of using one solid square of silicon make the production cost of string ribbon silicon panels a bit lower than the production cost of polycrystalline silicon panels.

Amorphous Silicon Panels – Amorphous silicon panels have the lowest electricity return rate of any type of solar panels. Traditionally amorphous silicon solar panels have an electricity return rate of between 5%-6%. That's because these panels aren't made with crystalline silicon. They are composed of a piece of semi conductive metal, like copper, with a thin silicon film over the top that is attached to some metal pieces.

These panels are very cheap to produce but when you're buying solar panels for home use you need to consider the long term efficiency of the type of panel that you're buying. Unfortunately, though cheap to begin with they do not produce much energy, therefore amorphous silicon panels are not going to be cost effective in the long run.

## Solar Panel Shingles

If you're building a new home or if you are replacing the roof on your house you might want to consider using solar panel shingles for your roof. Solar panel shingles are cutting edge technology that only recently hit the consumer market.

Solar panel shingles are the same size as traditional asphalt shingles but they are actually small PVsolar cells. They fit together like traditional roof shingles. You can also use a combination of solar panel shingles and traditional shingles if you can't afford to do your entire roof in solar panel shingles although you won't get a very high return electricity rate if you use just a few solar panel shingles.

Solar panel shingles are weather resistant and function just like normal shingles except that they also can provide clean, environmentally safe and free solar energy to power and heat your home. Using an entire rooftop of solar panel shingles is usually more than enough energy to power your home except for some exceptionally large appliances like a washer and dryer.

Solar panel shingles aren't cheap, but they can help you save money on energy costs over time. Here are some of the other benefits of using solar panel shingles to power your home:

- Solar shingles are easy to integrate with existing roof structures and shingles
- Solar shingles fit into any design style
- Solar shingles can decrease your electricity bill significantly, sometime by more than half
- Solar shingles are environmentally friendly
- There are lots of state and Federal Green Building financial incentives to use solar shingles
- Solar shingles will increase the resale value of your home
- Solar shingles are a smart long term investment in your home equity
- Solar shingles are easy to install
- Solar shingles have at least a 20-year output meaning you won't have to roof your home again for probably 20 years.

## **Solar Panels and the Environment**

You already know that switching to solar energy can have a big effect on the environment, but you might be wondering just how big an effect. After all, can one person or one family switching to solar energy for heat and electricity really make that much of a difference on the environment?

Yes! One person or one family can save 20,000 tons of greenhouse gas from polluting the environment just by using solar energy to heat your hot water and heat your home. 20,000 tons is a lot of greenhouse gases! And that's just if one home just switches to solar energy. Imagine the decrease in greenhouse gases that could happen if 20,000 people per year switched to using solar energy to heat their hot water and heat their home. Add to that the effects of reducing energy consumption by 50% if you use solar energy for electricity and suddenly the impact on the environment is enormous.

In addition to reducing the amount of greenhouse gases that you put out switching to solar energy has a big impact on the environment because you will be reducing the amount of fossil fuels that you are using. Fossil fuels are very bad pollutants and contribute directly to poor air quality and other environmental problems.

The environment isn't just hurt by people burning fossil fuels for energy. The environment is also hurt by what is necessary to get those fossil fuels. Enormous portions of the earth need to be dug up, processing plants and refineries built, and natural ecosystems destroyed all over the planet just to get to the fossil fuels that are buried in the earth. Most of the pristine wilderness is gone in any country that has natural deposits of fossil fuels because of the ever-growing demand that countries around the world have for fossil fuels.

When fossil fuels are processed there is a huge amount of solid waste, much of it toxic, that is left behind. This waste takes up space in landfills and then seeps into groundwater while the runoff flows to the waterways polluting the water and the soil. The carbon dioxide and other gases that are released poison the air for miles around the processing plants of these fossil fuels.

Solar energy might not solve all of the environmental problems that we face as a result of the overuse of fossil fuel but it's a start. Just having a few thousand people per year switch to using solar energy to heat and power their homes will be a big step towards creating a safer, cleaner environment for everyone. And since the costs of buying and installing solar panes is dropping all the time soon it will be a lot more common for homes to use solar energy for their power needs.

## **The Benefits of Using Solar Energy in Your Home**

There are many benefits to the environment when people use solar energy to heat and power their homes. There are also many benefits for homeowners. At first the cost on installing a solar array so that you can solar energy at home might seem very expensive but over time the solar energy panels will more than pay for themselves. Still not sure that solar panels are right for you? Here are just a few of the benefits of switching to solar energy in your home:

Solar panels last a long time – If your solar panel array is installed properly it can last for 20 years or longer. Proper maintenance is required to keep it functioning well but the solar panels themselves shouldn't need to be replaced for at least 20 years. Solar roof shingles can last even longer depending on the type of climate that you live in.

Solar panels create quiet energy – The heat and electricity generated by solar panels is practically noiseless so you will be making your home a lot quieter to live in when you switch to solar energy.

Solar panels are one of the most low maintenance home improvements – Solar panels do require some maintenance but overall they are pretty easy to take care of. After they are installed if you check them regularly for damage and replace any broken or damaged PVcells you shouldn't have to do much more maintenance on them.

Solar panels can protect your roof and siding – Since the solar panel array shades the house it means that your roof and siding will last longer because the solar panels will act as a buffer between your home and the elements.

Increased home value – Installing solar panels is really an investment in your home because the resale value of your home will rise significantly once you have solar panels. There is a lot of interest in living in a more environmentally responsible way these days and customers that are looking for new homes are concerned about the impact of their homes on the environment. Having solar power is quite a draw for home buyers.

Solar energy saves money. Even though installing solar panels isn't cheap once the solar panels start to create energy you will start to see a huge savings in your monthly electric bills and heating bills. You can end up paying next to nothing or even nothing at all for electricity. That is probably the biggest reason that so many homeowners are considering switching to solar energy.

## How Much Money Can Installing Solar Panels Really Save?

For most homeowners the decision about whether or not to install solar panels really comes down to the cost of the solar panels and installation versus the long term savings that using solar energy can provide. So how cost effective is it to install solar panels?

No one can calculate exactly how much money you can save by using solar energy because energy prices fluctuate and there are other factors that need to be taken into consideration. But, many homeowners that have switched to using solar energy report that they have cut their energy bills from usually 50% to as high as 90% which can add up to a lot of money saved over the course of 20 years.

Another factor to keep in mind when you are considering buying solar panels for your home is that homeowners can usually get large grants and rebates from state and Federal programs to help defray the cost of buying solar panels. So you might be able to install solar panels in your home for a lot less than retail price if you qualify to take advantage of those incentives. Many solar panel dealers will help you fill out the paperwork necessary to get those rebates and grants.

If you are building a new home then the cost of buying and installing solar panels for energy can be folded into your home loan or home mortgage so that you won't have to put in any money up front to install them. Since the solar panels will be part of the home and will add value to the home most mortgage companies look at the cost of solar panels as a home improvement.

If you have a pre-existing home that you want to fit with solar panels you can take out a mortgage or secure a home equity line of credit to finance the up front cost of the solar panels and the monthly energy savings that you have as a result should more than pay for the loan payments. The home improvement of adding solar panels also increases the value of the property.

Once the solar panels are installed it takes awhile for the cost of the installation to be absorbed but after that point the amount of money that you save can be hundreds of dollars per month depending on the price of electricity and how much electricity you use. An existing home usually reaches the "payoff point" where the solar panels have paid for themselves in savings after about 6-8 years. A new home will reach the payoff point almost immediately.

## Solar Panel Use Around the World

Even though the use of solar energy in the United States is relatively new, people in other countries have been using solar energy for a long time. Right now Germany is the biggest producer of solar energy, followed closely by Australia.

Interest in solar power around the world increased during the Oil Embargo of 1973 and the resulting oil crisis that dragged through much of the 1970's. During that time the countries that had the richest deposits of oil in the Middle East refused to ship oil to the United States, Western Europe, and any country that had supported Israel. Faced with huge oil shortages and angry consumers businesses quickly began developing solar energy technology that had been abandoned when oil was cheap and plentiful.

Why have other countries adopted the use of solar energy so much quicker than the United States? The simplest answer to that question is cost. After the end of the Oil Embargo the United States developed strong ties with the OPEC countries that led to a large reduction in oil prices.

For decades the United States has enjoyed some of the cheapest fossil fuel prices of any developed nation because of the existence of fossil fuel deposits like coal and natural gas in the United States and good relationships with other countries like OPEC that have huge natural supplies of fossil fuels.

Fossil fuel prices in the United States are rising and consumers are shocked at how much they have to pay for gas and electricity that is coming from fossil fuels but for many countries around the world the costs that United States citizens pay is still much lower than the cost of gas and electricity in their countries that must import 90% or more of their fossil fuel products.

Now the focus is on solar energy around the world because the world is running out of fossil fuels, and the environment is changing at an alarming rate due to pollution from the use of fossil fuels and the destruction of the earth to get fossil fuels. Scientists, politicians, and homeowners that want to live in an environmentally responsible way while saving money on their energy costs are all trying to find ways to make solar energy more practical and more affordable for everyday citizens.

For homeowners around the world solar energy is quickly becoming a cheap alternative to costly fossil fuel energy. Since the cost of living is increasing fast homeowners need to find cheaper ways to power their homes. In addition, being able to generate your own solar power gives homeowners greater independence.

### **Solar Panel Use in the United States**

Since the United States has enjoyed low fuel prices and an abundance of sources for fuel traditionally using solar energy has never been something that was really popular. But with fossil fuel costs rising at an alarming rate and many people concerned about being able to afford to heat their homes or afford electricity combined with a growing awareness of the environmental problems caused by the use of fossil fuels it's becoming a lot more popular, even trendy, to use solar energy.

Currently about 0.1% of all the energy generated in the United States is solar energy. This is mostly because of the cost of buying and installing solar panels and a lack of education about the benefits of solar energy. But, The Utility Solar Assessment Study, a recent scientific study about solar energy use in the United States, predicts that by 2025 10% of all the electricity in the United States will come from solar energy.

This is because solar panes are being made more efficiently and in greater numbers which is bringing the cost of using solar energy down to a point where most home owners can afford to use solar energy. Also, the Federal government and almost every state are offering homeowner tax rebates, grants, and other financial incentives to encourage them to install solar panels in their homes. Especially in states that are known for constant sunshine like California and Florida solar energy is becoming just as cheap as fossil fuel energy.

The study also predicts that by 2015 the cost of solar energy in most major cities will be on par with the cost of fossil fuel energy even with the set up and installation costs of buying solar panels. By 2025 it will be cheaper and more efficient to use solar power to power most appliances and homes than it will be to use fossil fuel based energy.

Solar power is becoming more and more common so people are getting used to solar power as a viable option. One of the most popular uses for solar panels today is in garden lights. These are small lamps that light a yard, walkway, or light up a tree or wall. Rather than run electrical cords across the ground or bury them in the ground, which is expensive, if the garden light is powered by a solar panel, it can be placed anywhere and does not have to be wired. These lights are of course only on at night but their solar panels gather energy from the sun during the day and store it in a battery. Throughout the night the light runs off the battery's electrical energy.

Increasingly, roadside signs are powered by solar panels. Because of the cost and complication of running electrical wires to remote areas, the signs have solar panels installed which make electricity from the sun. Solar panels are especially useful for portable construction signs. Because they don't have to be plugged in they can be placed anywhere and get their energy from the sun. Many calculators are now powered by solar panels rather than batteries. Again, they don't have to be plugged in and as long as there is any light, even artificial light, and the solar panels can generate enough electricity to power the calculator.

As applications of solar power are increasingly becoming a part of our society, people are giving solar panels a second look. With costs decreasing and efficiency increasing, homeowners and developers are considering using solar panels more than ever.

## **Is Using Solar Panels Right for You?**

If you've been thinking about switching to solar energy you might be having trouble deciding if buying and installing solar panels is the right thing for you. After all, the up front cost to purchase and install solar panels isn't cheap and for some people the short term costs of investing in solar panels can be a burden. Here are some questions to ask yourself that will help you decide if solar energy is the right thing for you:

### **Can you afford the up front cost to buy and install the solar panels?**

Most people either add the cost of solar panels into the cost of their new home or use money from the mortgage to pay for the solar panels or take out a home equity loan in order to pay for them. If you're taking out a loan then you need to go over your finances and figure out if you can really afford the required monthly loan payment. Eventually the solar panels will pay for themselves but the up-front cost is such that at first you might be strapped financially after buying and installing them.

### **Can you live with the inconvenience?**

Solar power is variable. If there is no sun or very little sun on a particular day then you won't get any power from the solar panels and you may have to use grid electricity or go with reduced power for a time period. Are you willing to put up with little inconveniences to have a greener household?



### **Is your home set up for solar energy?**

Do you have the necessary space requirements and land requirements to support a solar array? If you're going to choose solar roof shingles do you have the necessary permits for building? Make sure that your home is properly set up for solar panels or solar shingles before you invest in a big purchase of solar panels or solar shingles.

### **Are you willing to do the maintenance?**

Solar panels are low maintenance but they still do require some maintenance. You will need to occasionally clean off the solar panels. They will gather dirt and debris over time and anything that blocks the sunlight from reaching the solar panels will decrease the amount of energy you will receive. If you live in an area which gets snow in the winter that means every snowfall you have to clear off the solar panels. Also, the electrical equipment required to run the electricity from the solar panels into the electrical grid of your home does require some watching. There are stringent requirements for this because of the variability of the energy coming from the solar panels. So, it requires some monitoring.

## **The Three Main Requirements for Using Solar Power in Your Home**

Solar energy will work in almost any home that physically has the space to support an array of solar panels. With the wide selection of solar panels available it's not that hard to find solar panels that are the right shape and size to fit into any building. Still, there are certain things that your home has to have in order to effectively use solar panels and solar energy. The three main things that your home needs in order for solar power to work at your home are:

1. Enough space to put the solar panel array.

If you don't have enough land or roof or wall space to put the solar panels on the house then solar energy isn't going to be effective for you. Depending on the type of solar panel that you choose you might have to have a large solar array in order to generate enough energy to power your home which would make it necessary for you to have some open space. If you live in a crowded city you might not have room for solar panels although solar shingles might be a good option for you. Local building codes may also restrict your options of solar panels. Be sure and check with your local government as to any restrictions they put on the size and location of solar panels on a building.

Since solar shingles go on the roof of the home just like a traditional roof solar shingles make it possible for homeowners that don't even land to support a lot of solar panels to gather and use solar energy. Some types of solar panels can be installed on your roof without damaging your existing roof shingles but if you decide to install solar panels on your roof you should have a professional do the installation to make sure that your roof isn't damaged during the installation.

## 2. Enough sun to make the panels work.

If you live in a climate that is cloudy most of the time or dark a great deal of the time then you will not be able to use solar panels effectively. Unless the solar panels are exposed to direct sunlight for most of the day everyday they will not generate enough energy for you to use. The more sun there is the more power you can generate.

If you live California, Arizona, Florida, or a state where it's bright and sunny most of the time then solar energy is a great option for you. If you live in a state that sun part of the year and lots of storms or snow the rest of the year then you can still save money using solar energy for some things but you're better off using grid electricity during the winter.

Another factor is how far north you are. The farther north one is on the planet, the lower the sun is in the sky. This means that the rays of the sun are hitting the solar panel at a more oblique angle so less actual light energy is hitting the solar panel. In northern states like Minnesota or Maine solar panels are going to be less efficient than in southern states like Louisiana and Florida.

## 3. A way to finance the price of the solar panels.

A solar panel isn't cheap. A high quality solar panel array plus installation could cost in excess of \$20,000. It's important to make sure that you have worked out a way to afford the cost of buying and installing the solar panels before you go to purchase them. Remember that you don't have to pay the entire cost of the panels out of pocket in most cases because there are lots of grants and incentives you can get to help cover the cost.

## **The Top Five Reasons to Install Solar Power in Your Home**

Still not sure if using solar power is the right thing for you? Here are the top five reasons why buying and installing solar panels to provide your home with solar energy make sense:

### 1. It helps the environment.

This is a big deal. The less fossil fuel energy that people use the more we can help sustain the environment and slow down global warming. If you and everyone you know switched to solar energy you could really make in impact on the environment. Even though switching to solar energy seems like a small thing when it comes to the environment small things like going solar really do make a difference.

### 2. It doesn't cost as much as you think.

Most people think about going solar but ultimately decide that the price is too high. But the cost isn't as high as you think once you factor in the various grants, incentives and rebates that you can get from the Federal government and the state that you live in which reward homeowners for going solar.

### 3. You can save money.

Over the length of the life of your solar panels you can save thousands of dollars by powering and heating your home for free, or virtually for free. Even though the up front costs seem high when you consider the amount of money that you will save in energy costs the up front costs seem pretty reasonable.

### 4. You can make money using solar energy.

Did you know that? If you make more solar energy than you use in your home you can sell your excess energy back to the power company and make money. Many states have laws that require the electric companies to buy excess power from property owners generating their own electricity. Not only can you power your home for free using solar energy, you can make money using solar energy. You won't make enough money to quit your job or retire, but you could make enough to help out with household expenses.

### 5. You'll be self-sufficient.

You will never have to worry about going without electricity during a power outage or worry about what will happen if there is a storm that knocks out power to your area for days or even weeks. With the weather getting more unpredictable every year because of the effects of global warming using solar energy can give you peace of mind that no storm or power problem will interfere with your home having power and heat.

## How Many Solar Panels Do You Need?

Determining how many solar panels you need to buy in order to power your home with solar energy can be tricky. In order to figure out how many solar panels that you will need you first need to figure out how much energy you need to run your home normally and how much sun your area gets on a normal day. Let's start by figuring out how to calculate how much energy you use on a daily basis.

Figuring out how much power your home uses each day

Even if you're using solar energy to power most of your home you will probably still be using grid electricity or gas to power large appliances like your water heater or your washer and dryer because solar energy is really not cost effective to use for major appliances. So you will be using solar energy to power things like your lights, TV, computer, phone, cable, refrigerator, microwave, kitchen appliances, and so on.

To figure out how much energy you use to power those things you will need to look at the detailed figures of your electric bill. Most people just take an average of the amount of energy used per hour because it's easy to find that on the bill. So for the purposes of this example let's say that an average home uses 800 watts per hour. Multiply 800 watts per hour times 24 hours in a day and you get 19,200. So the average home uses 19,200 watts of energy per day.

Now you have to look at how much energy a solar panel is capable of putting out each day. A typical consumer solar panel is capable of putting out 70 milliwatts of power per square inch every five hours. So multiplying 70 times 5 you get 350 milliwatt hours per day. Dividing 19,200 watts of energy used per day by 350 milliwatts of output by a single solar panel and you will need about 54,000 square inches of solar panel to create enough electricity to provide power for most of the appliances in the house.

Now that's calculating for just basic appliances. If you want to add one room air conditioner you need to double your power output. So, if you want to use solar energy to power your entire house and you want to keep the initial cost of buying and installing solar panels down you should think about switching to smaller, more energy efficient appliances and learning how to conserve energy as often as possible.

Having this basic information about the size of the solar panel array that you will need will make it a lot easier for you to get accurate quotes from solar panel dealers because most of the time solar power systems are priced per square foot. Every home is different so every home needs a different amount of solar panels in order to get useable solar power.

### **The position of your house**

The other factor that matters when it comes to determining how many solar panels you will need is the position of your house. Because the solar panels need to absorb as much sunlight as possible in order to work effectively the more of a southern exposure your house has the more power the solar panels will generate and the less of them you will need. Make sure that the position the solar panels need to go in has enough room to accommodate the number of panels that you'll need.

When you are figuring out where to put your solar panels try to figure out where due south is in relation to your house and plan on positioning the panels there.

To find out where due south is when it comes to your property you can take the number of hours between sunrise and sunset and divide that number in half. The position the sun is in at that time during the day is due south.

If your property doesn't have a due south exposure or you can only put the solar panels in an area that doesn't get a lot of sunlight you will need to either use an additional solar panel array on your roof, or put in some solar roof shingles, or you can also use a battery to help your solar panels produce more power.

When you make the decision to install solar panels it's best to have a trained solar panel consultant come to your property and look it over. A solar panel consultant can advise you on the best position for your solar panel array and can also help you determine exactly how many solar panels you'll need.

The amount of solar panels that you need to power your house will also depend on the type of solar panel that you choose. Different types of panels will give off different amounts of energy so if you're using your solar panels for full power in your home then you should consider getting the highest grade monocrystalline solar panels that are available because they have the highest electricity return rate and are the easiest to custom fit because they are one large sheet instead of groupings of individual PVcells.

If you are going to use solar power only as a supplement to traditional grid power and to do things like heat your pool and hot tub, or power your outdoor lights, then you can choose a less expensive type of panel or you can buy fewer of the high grade solar panels.

If you want to use solar power but aren't sure that solar power is going to be enough to power everything in your home then just installing a few solar panels and using some solar energy is a good way to find out how much solar energy your property can generate.

### **What You Need to Know about Installing Solar Panels**

The installation of solar panels is the trickiest part about buying solar panels because if the panels aren't installed the right way you will lose a lot of efficiency. You can pay a professional to install your solar panels for you, or you can try to install the solar panels yourself.

Solar panels aren't difficult to install if you're an experienced handyperson and have a lot of skill when it comes to working with tools. The difficult part of installing solar panels correctly is configuring them correctly. Transporting the solar panels and all the mounting equipment that you will need can also be difficult, so many people do choose to use a solar panel installation company to put up their solar panels.

You don't have to get solar panel installation from the company that you buy the solar panels from. There are specialized companies that just do solar panel installation and can install different types and different brands of solar panels for you. If you are going to have your solar panels professionally installed but you want to cut costs wherever you can try contacting the solar panel manufacturer directly. If you buy solar panels directly from the manufacturer you can save money on the up front cost of the panels and then you can hire a private solar panel installation company to transport and install the panels.

If you choose to install solar roof shingles you can easily install those yourself or if you prefer you can hire a roofer to do it for you. A regular roofer should be able to install the solar roof shingles but you should look around for a roofer that has had some experience with solar shingles.

Another thing to consider when deciding whether or not to install your solar panels yourself is the landscape of your property. If the solar panels need to be installed on the roof and you have a roof with a slope of 30 degrees or more it could be difficult or dangerous for you to attempt to install the solar panels yourself.

The bottom line is that there are always pros and cons to hiring a contractor to install the solar panels for you. At the same time, there are pros and cons to installing the solar panels yourself. So, before you make a decision look at all of the pros and all the cons of each option. If you make a decision about the installation of your solar panels based solely on price in the long run you may end up paying more.

## **10 Tips for Choosing A Solar Panel Installation Contractor**

If you decide to have your solar panels professionally installed don't just pick a contractor out of the phonebook. You are hiring someone to install some pretty pricey equipment so it's in your best interest to make sure they know what they're doing. Do some research and then consider these 10 points for each contractor to help you choose the right solar panel installation company:

### **1. Where is the company located in relation to your property?**

Is it a national chain company with franchises or is it a local company? All else being equal, a local company is better to deal with given that it is more accessible for you and knows your area. The company should be local so that you can get a service technician to come out and service your panels if there is a problem and also to cut down on the cost of transporting the panels and the time to get an installation appointment.

### **2. Is the company certified?**

This is a big one. In order to be qualified to install any type of PV solar energy systems or solar panels a company should be certified by the North American Board of Certified Energy Practitioners, or NABCEP. Ask if the company is certified and then go online to the NABCEP website to check and make sure the company is currently certified by NABCEP to do solar panel installation.

### **3. Does the company subcontract their work?**

Sometimes it might be ok for a company to use a subcontractor but not when it comes to solar panel installation. Ask the company specifically if they use a subcontractor. If they do, you can either ask if the subcontractor is also certified by NABCEP or just choose another company.

### **4. What is their Customer Service like?**

When you're buying and installing solar panel you are going to be spending a lot of money, usually upwards of \$20,000 for the panels and the installation. That should entitle you to some good old fashioned customer service.

If you contact a solar panel installation company and they don't return your phone calls, or try to get you to sign up for installation before they are willing to answer your questions then you should choose another company. A reputable solar panel installation company will be happy to answer your questions and help you with your concerns about your solar energy installation without pressuring you to buy their services.

#### 5. How much installation experience does the company have?

Ask how many solar panel installations they have done but also ask about the employees. Ask how long they employees have been with the company and how experienced each employee is. If the company has done more than 50 solar panel installations but they put a brand new tech that's never done a single installation, your installation project you could still end up with an incorrectly installed solar array so ask specific questions about the employees' experience.

#### 6. What is the company's reputation?

Ask around town to see what people think of this particular company. Ask them for references that you can call, ideally from other people that they have done solar panel installations for. Go online to the Better Business Bureau website to see if the company has had any complaints filed against it. You will be giving the company that you choose a lot of money so check them out thoroughly and make sure they're trustworthy.

#### 7. What brands does the company have experience with?

Find out what brands and models of solar panels they are certified in or have experience in. Each company that makes solar panels makes them a little differently and it's important that the company you choose to do the solar panel installation has experience working with the particular brand name and model that you bought. The company's NABCEP license should also tell you what models and brands the company is certified to work on.

#### 8. What kind of a warranty does the company offer?

Every solar panel installation company should offer some type of warranty on their work. It's important that you know the details of the warranty that the company offers because if anything goes wrong with the solar panels as a result of the installation you don't want to have to pay to have it fixed.

#### 9. What payment terms and payment plans does the company offer?

Always find out what payment terms the company accepts up front. Some will want full payment before the work begins, some will want a deposit with the balance due at the completion of the work, some others may offer monthly payment plans to help alleviate the financial hit of the installation cost. It's important that you understand the payment terms going in so ask the company directly what their payment terms are before signing anything.

#### 10. Will the company help you with rebates?

There are lots of rebates and other incentives that are available at the state level and the Federal level but often in order to get those rebates you need signed documentation sent in by both the company that you bought the solar panels from and the company that did the installation. So ask if you're not sure if the company is willing to provide the documentation and signatures you need in order to get those rebates.

## 5 Tips for Safely Installing Your Own Solar Panels

If you're a skilled home handyman and want to tackle the installation of your solar panels yourself to save money you can probably install them without a lot of hassle but to make sure that you install your solar panels safely follow these tips:

### 1. Make sure you have enough mounts.

There is nothing worse than getting to the end of the project and realizing you don't have enough equipment. This is especially true when it comes to installing specialty equipment like solar panels. Most of the time additional mounts and racking equipment needs to be special ordered to fit the brand and model you're using so make sure before you start that you have all the mounting components that you need.

### 2. Get help with the electrical components.

If you are not a certified electrician hire one to help you install the electrical system of the solar panels that converts the sunlight to energy and directs that energy into your home. You could seriously hurt yourself if you don't know what you're doing so it's worth spending the extra money to get help from someone that does know what they're doing when it comes to electricity.

### 3. Check and double check the position of the solar panels.

The location and tilt of the panels has to be right or they won't work. Be absolutely positive that the panels are facing due south and that they are positioned correctly before you complete the installation.

### 4. Use the buddy system.

When it comes to installing solar panels on a roof make sure that you use safety precautions and have a buddy standing by to help you if something goes wrong. No matter how experienced you are working on a rooftop can be dangerous, and working with large, unwieldy solar panel arrays on a sloped roof can be tricky for anyone. Having a friend or two around to help will make it easier for you to maneuver the large solar panels and will also make sure that if an accident were to happen you would have someone there to call for help.

### 5. Be thorough.

You won't get a second chance to do this installation and you are working with at least \$10,000 worth of solar panels most likely so take your time and make sure that you get it right the first time. Do some research about how to safely install solar panels yourself and make sure that you feel comfortable working with the panels before you start. Remember that you are attaching something permanently to your house.

Solar energy panels can make a great money saving addition to your home that will boost your resale value and cut your energy costs but only if they are installed correctly so that they can work efficiently. Make sure that if you install the solar panels yourself you position them correctly and mount them correctly in order to get the maximum benefit from your investment.



## **The Cost of Installing Solar Panels for the Average Homeowner**

It's difficult to gauge the cost of purchasing and installing solar panels because the exact price will depend on several factors. The type of solar panel system that you buy, the manufacturer, the amount of power that you want to generate, the cost of installation, and amount of rebates and incentives that you can get back from the state and Federal government all will play a role in how much your solar energy system ends up costing.

However there are some general guidelines when it comes to solar energy cost that might give you at least a rough estimate of how much it would cost you to install solar panels in your home. Industry experts say that generally a single, small, mid-grade PV solar pane that will produce about 75 watts of energy cost about \$900 installed. From that cost they can estimate that the cost per watt for solar energy is about \$12 per watt. One Kilowatt, the average measurement of electrical power, is 1000 watts so one Kilowatt of solar power will cost approximately \$12,000.

So what does that mean to the average homeowner? Well, if you run an extremely energy efficient home you can run your home with a two Kilowatt solar energy system. A two Kilowatt solar array would cost approximately \$20,000 or about \$10 per watt. Most modern homes, especially homes where there is a family, need about 5 Kilowatts of power. With discounts and rebates it's possible to get a decent 5 Kilowatt solar energy system for about \$40,000 installed, which averages out to a cost of \$6-\$8 per watt.

Those high numbers might send you into a big of sticker shock but keep in mind those are just estimates. There are lots of factors that affect the price of a new solar energy system so until you get a custom assessment of your home and the cost of putting solar panes in you home there's no reason to panic.

You also might not decide to use solar energy for all your energy needs but just some of the energy that you use everyday which will make the price of solar panels much more affordable because you won't need as many of them.

Don't forget about the rebates, incentives and grants that you can get from the Federal and state governments for installing clean, green, environmentally friendly solar energy in your home. Since there is a big push in the government right now to help consumers and homeowners embrace more green technology you can significantly reduce the cost of buying and installing a solar energy system using government money.

## **Grants, Rebates, and Other Financial Incentive Programs**

Most of the countries in the world offer incentives or rebates to their citizens to install and use solar energy. Japan was one of the first countries to start this in the early 1970's, about the same time as the oil embargo. Adding up all the different types of aid that homeowners in Japan get to use solar energy the cost of using solar energy in Japan is discounted by about 70% from the retail cost.

The US hasn't always offered great incentives to homeowners to use solar energy but that is quickly changing. The list of incentives that are offered changes frequently so make sure that you stay updated on what incentives are still being offered before you buy your solar energy system.

## Federal Financial Incentives for Using Solar Energy

Here are some of the programs offered by Federal governments plus some federally sponsored private programs that provide financial incentives for people to install solar energy systems in their buildings. Check with your government offices for more information or additional programs.

### Residential Energy Conservation Subsidy Exclusion

This is a tax rebate that allows homeowners that have installed an alternative energy source like solar energy to claim a tax credit on their yearly taxes for the amount of money that they would have spent using traditional grid electricity.

### Energy Efficient Mortgage

This Federal loan program allows homeowners to borrow the full cost of installing alternative energy systems to a new home or an already existing home and guarantees the loan. So if you don't have great credit or you wouldn't qualify for a loan through another lender you can still apply for the Federal Energy Efficient Mortgage loan and be approved since the government guarantees the loan. The Energy Efficient Mortgage is different than the Energy Star Mortgage.

### Energy Star Mortgage

An Energy Star Mortgage is not guaranteed by the Federal government and is a private mortgage processed for the sole purpose of adding new energy efficient systems to a new or pre-existing home. Some Energy Star lenders allow homeowners that have older homes to borrow up to 5% of the home's value in order to pay for a new energy efficient solar energy system. Other lenders will only loan enough for the exact cost of the solar energy system.

Because Energy Star mortgages are not guaranteed by the Federal government if you don't have good credit you might not have an easy time getting a loan if you don't have an existing home you can borrow against. There are about 49 lenders that work with the government to provide Energy Star mortgages specifically to help homeowners absorb the cost of installing solar energy systems so if you don't have great credit don't assume you can't get an Energy Star mortgage, you might just have to go through several lenders until you find one that will work with you.

### Residential Energy Efficiency Tax Credit

This Federal tax credit gives you a rebate on 100% of the cost of buying solar hot water heaters or solar heating systems or will give a tax credit of 10% of the cost of all home improvements that you make to increase energy efficiency like installing solar heating in your home.

### Residential Solar and Fuel Cell Tax Credit

This tax credit gives you up to \$2000 back on the cost of a new solar fuel cell system or solar water heating system. But, in order to be eligible for this tax credit at least half of the power in your home needs to come from solar energy. So if you install a small solar energy system of one or two solar panels so that you can get some of the energy for your home from solar energy but you don't get 100% of your energy from solar energy you still qualify for this tax credit.

## **State Financial Incentives to Install Solar Energy Systems**

Every state offers different financial incentives and rebates to homeowners that are thinking about installing a solar energy system. Currently California and Nevada offer the most incentives for homeowners to use solar energy although Colorado, Florida, Indiana, and Oregon also offer a large number of incentives and rebates for their homeowners. California has more than 30 different incentive programs but those are mostly centered in particular cities and are given out at the city level, not at the state level.

All 50 states offer some type of financial incentives to use solar energy or green energy although the amounts vary. Most states offer some type of home loan or mortgage that are specifically for solar energy panels or energy upgrades or to install a new solar energy system or a new solar shingle roof in a new home that is just being built.

To find out more about what financial rebates or incentives are available where you live use the Database of State Incentives for Renewables and Energy. DSIRE has been working since 1995 to be an accurate clearinghouse of information about green energy initiatives and financial incentives for every state. They can also tell you who to contact in your state if you have special circumstances or need help. You can visit DSIRE online at [dsireusa.org](http://dsireusa.org) and search through the database for financial programs related to solar energy that are available in your state.

## **Making Your Own Solar Panels**

If the cost of buying and installing solar panels still seems out of reach you might be thinking about trying to make your own solar panels. Can you really make your own solar panels? The answer to that is yes, and no.

You can make some small non-PV types of solar panels on your own. You can use these solar panels in a homemade solar water heating system or sometimes even in a solar heating system. You can use homemade solar panels for passive heating but you cannot make PV solar cells capable of providing enough energy to power your entire home on your own. Consumers just don't have access to the kinds of materials that are needed to create high intensity PV solar cells.

PV cells are simple in design which makes some people think that they would be easy to make but the materials are very specific and need to be produced in exactly the right conditions in order to generate electricity. You won't be able to find the ultra concentrated crystalline silicon that you need to make a PV solar cell at your local home improvement store or the conducting metals that you need at the local discount store.

If you want to try out using solar power or just decrease your energy bills by making your own solar heating panels you can do that on your own. There are kits that you can buy containing the supplies and instructions on how to build your own solar heating cells or you can pick up the materials yourself at the local home improvement store and get free instructions on how to build a solar heating cell on the Internet.

Be very careful using directions off of the Internet on how to build a solar heating cell. This is because chances are good that those instructions haven't been very well tested and the solar cell that you build might not even work. Be sure though that when you are looking for instructions on how to build your own solar heating cell look for feedback from people that have used the directions that you are thinking about using to build a working solar heating cell. This way you have some kind of proof that it actually does work.

If you don't want to put the time and effort into building a solar heating cell some home improvement stores, hardware stores, or electronics stores sell pre-assembled solar heating panels that you can buy to create your own solar heating system. There are also stores specializing in solar energy systems that can sell you what you need for whatever level of do-it-yourself involvement you are looking for.

### **Tips for Making Your Own Solar Panels**

If you've decided that you do want to try making your own solar panels you'll find that it's not that difficult to make them but it might be difficult to actually make them work. Here are a few tips that will help you build working solar heating panels:

Check the instructions carefully – If the instructions seem like they don't make sense, you probably won't end up with a working solar cell. Reread the instructions until you understand them completely. Don't just assume you know, be sure.

Get all your materials at once – When you're out shopping for the materials for your solar cell make sure that you get everything you will need so that once you sit down to start work on the cell you won't have to stop and go get something you forgot.

Get backup materials – If you can afford it it's a good idea to get two of everything that you will need to make the solar cell so that if you make a mistake you'll have fresh materials on hand.

Make a practice cell – Follow the instructions given but use inexpensive materials like wood or cardboard just to see if the directions are clear, easy to follow, and will create something that has a good chance of working.

Don't expect too much – You are building a solar heating cell, not a PVcell, so even if you make 100 of them they aren't going to power your home. If you have clear expectations about the capacity of the solar cell you're building then you won't be disappointed with its performance later on.

Use your solar cell – Put that cell to good use, don't just let it sit in the basement. You might think that just having one solar cell won't do any good but even one solar cell can provide power. If you really want to start using more solar energy for heating build several cells and make your own solar panel.

Use the right tools. Your solar heating cell won't work if you aren't using the right materials to make it and that includes tools. If you don't have the tools that you need to build your own solar cell try to borrow some from a friend or neighbor or buy some new tools.

## 10 Ways to Use Solar Energy Around Your Home

You already know that you can use the energy from solar panels to power things like your lights or appliances but there are lots of other ways that you can use solar energy around your home too. So if you don't want the expense and hassle of installing a full solar power system to give you electricity for the entire house you can start with a smaller solar set up to power some of the things around your home. Here are 10 ways to use solar panel energy to operate things besides your lights and appliances:

### 1. Your outdoor lights.

You can use solar energy to power your garden and walkway lights and other outdoor lights. Solar energy garden lights to light your sidewalk or garden paths are inexpensive and can be purchased in different styles at your local home improvement store. The solar cells on the lights gather energy from the sun and store that electricity in small batteries on the light. At night the battery powers the light. A few years ago only low-powered mood lights were available as solar powered. With recent advances in solar cell and battery technology there are now some powerful flood light available that are solar powered. Solar outdoor lights are a great way to see how solar energy works before you spend thousands of dollars on a solar panel setup.

### 2. Your pool and hot tub.

Many pools and hot tubs now use solar energy to heat the water. The solar power unit usually assists the electric or gas heating units and even if the whole system isn't heated by solar power alone, the solar power assist will still save you on your heating bill. If you have an older pool or hot tub that doesn't have a built in solar energy system you can purchase a solar power kit from a pool supply store that you can use to convert your existing pool or hot tub heater into one that uses solar energy for heating. It will pay for itself in energy savings.

### 3. Use a solar oven.

As mentioned earlier, the first harnessing of solar energy was to cook food in a specially designed oven that focuses the sun's rays to heat food. Originally these small ovens were built for camping but they work great for summer cooking too! Rather than mess with charcoal or propane tanks, solar ovens are cheap and easy to use without all of the waste of conventional cooking techniques. These small ovens can cook food at a temperature up to about 350 degrees and are fully solar powered. A unique system of glass and reflective material absorbs the sun's heat like a solar PV cell and then magnifies it so that it gets hot enough to cook. Ditch the electric or gas grill and use a solar oven for your backyard cooking.

### 4. Use "passive heat" storage tubes to increase and store solar energy.

Using these innovative greenhouse fiberglass tubes can really cut down on your heating bills in the winter. These tall fiberglass cylinders are perfect as room accents or room dividers. They look like pillars, but they are hollow. Fill them with water and they will catch and store energy from sunlight which can fill the room with heat. In the winter make sure that they get lots of exposure to bright winter sun and they will help keep your home warm without a huge heating bill.

5. Use solar chargers to charge your MP3 player.

Yes, your cell phone, your laptop and other electronic devices that you use everyday run on batteries. Hopefully you are already using rechargeable batteries to help save cost and reduce toxic waste. There are several solar powered chargers on the market that either charge internal batteries, like in cell phones, or charge C, D, AA, and AAA batteries. These solar rechargers come with different size cords so that you can use it with different items. Using solar power to charge these items you use everyday can take a chunk out of your electric bill each month.

6. Use solar powered appliances.

Ok, maybe it doesn't make sense to use solar powered appliances in the house when you're opening and closing the fridge 20 times a day. But there are solar powered refrigerators and freezers that are perfect for food storage. How many people have a second freezer or refrigerator or both in the garage for storing frozen or refrigerated food? Lots of people do. Lots of people also keep a small refrigerator in the home office, in the garage workshop, or on the patio to keep cold drinks and snacks in. Using a solar powered fridge or freezer can save you money and show you how well solar energy works.

7. Heat your water with solar power.

You can install a solar water heater system for a fraction of the cost of a full solar power system. Using a solar water heating system will save you money and give you a great idea of what living with a house powered only by solar energy would be like.

8. Use solar indoor lights.

You can burn up a lot of expensive energy using regular lights. Instead of using overhead lights use solar powered desk and floor lamps to light up your home at night. Like the outdoor lights these indoor lights capture light energy during the day and store it in a small battery. At night the small battery powers the light.

9. Try using solar powered electronics.

Now you can use solar energy to charge your electronics or you can skip straight to solar powered electronics. You can buy solar powered Bluetooth headsets, MP3 players, cell phones and other items that you need to use everyday. You should also have a solar powered radio in the house in case the electricity goes out and you need an emergency radio.

10. A solar power generator.

Every home should have a generator in case the power goes out, and using a solar power generator will ensure that you always have power. All you need to do to recharge your solar generator is set it in the sun, so if you were struck by a natural disaster or other emergency that wiped out your power you would have enough energy to power the things you needed for days or even weeks if you had a solar generator available. It's also a smart idea to keep solar powered flashlights and lanterns in a sunny place just in case of emergency.

These are just a few of the many ways that you start using solar power around your home to see how well solar power work and how reliable it is before you decide to go all the way and install a full solar panel array to provide power for your home.

## **10 Ways You can Save Money Using Solar Power**

Most people want to install solar energy systems because they will help save money. Of course it's nice to help the environment but the bottom line for most consumers is that if they're going to spend \$20,000 on a solar energy system it should save them some money.

But you don't have to install an expensive solar panel array in order to save money using solar energy. You can use solar energy in lots of little ways around the home to save money every month. Here are 10 easy ways to use solar heating and solar energy to save money:

### 1. Put your lights on a solar timer.

During the day this solar timer/battery charges in the sunlight and at night powers your reading lamps, nightlights, and other lights. A solar timer is better than a regular timer because you only need the lights on when it is dark. A solar timer won't turn on your light until it is dark enough to require lighting. It will cut down on a lot of your grid electricity usage. Putting your lights on a timer is also a good idea if you're not at home during the day and don't come home usually until after dark because it will make the house look more lived in and less attractive to burglars.

### 2. Install a solar water heater.

A solar water heater can make a big difference in your energy usage without costing a fortune. Heat your water for washing dishes, laundry, baths and showers with solar energy and you can use a lot less traditional electricity. To increase your energy savings even more use a solar heating blanket around the water heater to stop heat leaking and increase the efficiency of your water heater.

### 3. Use solar heating to heat your home.

This is a big one. Using solar energy for heating is the most direct and efficient way of taking advantage of solar power. Since the sun gives heat, using it for heat is more direct than converting sunlight to electricity. Fuel costs are rising every year and many people are worried that they won't be able to afford to heat their homes this winter. Install a solar heating system and you can use a lot less energy to stay warm this winter.

### 4. Use solar batteries.

Instead of plugging in your electronics to the grid electricity use rechargeable solar batteries for things like radios, MP3 players, cell phones, flashlights and other things that you use all the time. You can even get solar powered batteries for your laptop computer that will hold a charge long enough for you to get work done on the computer. You can also recharge solar batteries easily anywhere you are so you will never have to worry about a dead battery again.

#### 5. Using a solar powered stove.

Think of using a solar stove as an environmentally friendly microwave. There are all different kinds of solar stoves that can do anything from warm up last night's pizza to cooking a pot roast for dinner. A solar stove is safe and energy efficient and doesn't use costly gas or electricity.

#### 6. Use a solar air conditioner.

That's right! A new solar air conditioner has been developed by an electronics company. It's a room size air conditioner that runs entirely on solar energy and can cool a medium to large sized room easily. When there is no sun it runs on batteries. Installing solar air conditioners instead of traditional room air conditioners could save you a bundle on energy costs during the hot summer months.

#### 7. Use solar appliances.

Like every other solar-powered device, an appliance powered by solar energy means you do not have to pay the utility company for the energy to run the appliance. There are an increasing number of solar powered appliances that you can buy. Many of them are specifically meant for vacation homes and cabins that may be off of the electric grid but there is no reason you can't use them anywhere. These appliances might not be as large or powerful as the ones you're used to but can run efficiently and save you a lot of money on energy costs.

#### 8. Install a solar powered water purifier.

Another new solar powered energy saving device that is just coming onto the market is a solar powered water filtration system that will filter all the water in your home. You can save money over buying bottled water and enjoy cleaner, fresher water using a solar powered water purifier. The same company also makes a solar powered air purifying system. Using no electricity off of the electrical grid, it costs nothing to operate.

#### 9. Use solar power to run your ceiling fans.

You might not realize how much energy you use just running your ceiling fans. Ceiling fans help with air distribution and can help keep your overall energy costs down so using them is a good idea but using them with a solar powered device is even better for saving energy. The solar power device connects into the wiring of the ceiling fan and runs the fan entirely on solar power.



10. Use a solar powered heater.

Almost a no brainer there but unfortunately still only a concept. The same company that has created the solar powered air conditioner also has plans to market a solar powered heater. It works like a traditional room heater but it runs on solar power. These solar space heaters are great for warming up a kid's room at night where you don't want to have electrical cords that might get tripped over or have a dangerous space heater. You can also use a solar heater when you're camping or traveling to keep you warm. A solar heat won't heat your entire house but it can help take the chill of a bedroom at night without costing anything in energy costs.

These are just some good ideas on how to save money by using solar energy. As the technology develops there will be many more ways to save money coming in the future.

### **What Appliances and tools Can You Run Using Solar Energy?**

We've talked a lot about the different ways that you can use solar energy in your home to eliminate or at least cut down on your energy spending but you might be surprised to learn how many things you can run on solar power or solar energy. Here's an in-depth list of common household and lifestyle items that you can run using solar energy. Some you probably already know, but some will surprise you.

- Hot water heaters
- Dishwashers
- Water filters
- Small household appliances
- Heaters
- Air Conditioners
- Lights
- Electronics
- Refrigerators
- Freezers
- Stoves
- Lawn Mowers
- Tools
- Batteries
- Flashlights and lanterns
- Pool heaters
- Fountains

These are just some of the appliances that now have solar powered versions Available. As technology advances and the price of solar cells go down, there will be an increasing number of solar powered appliances that you can buy.

## The Next Wave of Solar Energy– Wearable Generators

Because solar energy is becoming increasingly practical and cheap, scientists are always experimenting with new ways to use solar energy to power the products that people use everyday. The newest trend of useable solar energy for consumers is wearable solar energy generators; wearing, not as jewelry, but as useful power sources.

These innovative designs have build in solar panels that grab and use energy from the sun and other light sources to power items that people keep on them during such as MP3 players, cell phones, Bluetooth headsets and more. PDAs and other items that need to be recharged often can be easily charged by plugging in the device to a solar cell that is sewn into a backpack, a purse, a shirt, or even a bracelet. This technology is very cutting edge and still evolving but is definitely a wave of the future.

Here are some of the latest up and coming solar products that are starting to hit the market:

### Backpacks

These are just like standard backpacks except they are capable of generating 14.7 watts of power which is enough to fully charge a laptop computer. These backpacks and messenger bags are ideal for students who are on the move all the time but need to have laptops and other electronics with them and ready to use. Busy professionals always enjoy these backpacks and messenger bags.

### Purses

Women don't have to be afraid of getting stuck with a dead cell phone anymore. There is a new line of purses and handbags that come with solar cells in the fabric of the handbag that gathers energy as the bag sits in the sun. You can recharge a cell phone, PDA or other electronic device while it's sitting in you purse.

### Clothing

A professor at the University of Toronto has created a super thin film that can be used to capture solar energy. This ultra thin film can be sewn into clothing so that the energy can be used to charge cell phones and other items. The film is about 8 times more powerful than the most powerful PV conductive material on the market today so would easily be able to produce enough energy to power a laptop computer or other devices. Can you imagine being able to plug your laptop into your tie or your shirt to charge it? It's coming!

There are other innovative designs that use solar energy being created everyday but the combined creativity and usefulness of these designs shows that designers and scientists are going to make going green the next big fashion trend.

## Selling Power Back to the power company

There's another way that you can save money using solar energy, and that's selling your excess power to the power company. Many states have laws that require the electric companies to buy excess power from property owners generating their own electricity. Not only can you power your home for free using solar energy, you can make money using solar energy.

Most utility companies offer what is called "net metering," which describes how they take energy from your PVsolar energy system and upload that electricity to the power grid. You don't actually make money using net metering in that you don't get a check from the power company but you do get a credit to your account for all the energy that they take from your solar power supply. What that means is when you are producing excess power and sending it to the electrical credit you get credits that offset when you are not producing enough solar power electricity and have to take electricity from the grid.

Since most homes don't use solar energy for 100% of their power even if they have a PVsolar energy system having the power company give you credit for excess energy is a nice way to get rid of your electric bill each month. If you have more credit than you use that credit will just roll over from month to month, it's very rare for the energy company to actually send you a check; you'd have to have a huge solar panel array for that.

However, you don't need to have an ultra powerful solar panel setup in order to have excess energy that you can sell back to the electric company. Since the amount of power that you generate with your solar panes is dependent on how much sun your property gets it's possible that you could get enough sun during the hot summer months to build up a large credit with the electric company during the summer and then you can use that credit to pay for electricity that you need to use during the winter months when you don't get as much sun.

To be hooked up to the grid like this and be able to both take in and put out power required very specific electrical equipment. It is a different setup than if you were not connected to the grid and were powering your building directly and only from the solar panels. Fortunately, there are companies that specialize in this type of equipment and they can help you determine exactly the equipment you need.

Each power company has different rules about the application process to be approved for net metering so if you're interested in learning about net metering you should contact your local power company to find out the details of net metering where you live. Regardless of where you live you will probably have to have your solar panel setup inspected by the electric company and you might need to make some minor adjustments to your system in order to meet their qualifications.

Selling power back to the electric company or back to the grid as it's called is a great way to save money and it's just one more way that using solar energy can pay off for you. It also is a very good feeling to make the electric company pay you for a change! Using net metering even when you do need to use grid electricity you won't have to pay for it making the solar energy panels well worth the cost.

## The Future of Solar Energy

There's no doubt that solar energy will play a bigger and bigger role in how Americans get their energy in the coming decades. The fact that we are running out of fossil fuels and that the cost of fossil fuel is so high, combined with the fact that fossil fuels are causing serious environmental damage makes it essential to find other sources for energy that are clean, green, and efficient. Solar power along with wind power, hydro power, and other types of natural energy will become more commonplace as the years go on.

Since there will be so much focus on using green energy the cost of buying and installing solar panels will start to come down and hopefully there will be more Federal and state financial help for homeowners that want to start using solar energy to provide the bulk of the power that they need to run their homes.

At the moment it's not feasible for a typical homeowner to use solar energy 100% of the time but a homeowner that takes the plunge and invests in a solar panel array or a solar shingle roof can significantly decrease the energy costs for the home and might even earn enough credit through net metering to pay for the grid electricity that the home still needs to run major appliances like washers and dryers or to power the home when it's cloudy and the solar panels don't make any energy.

And it's not just homeowners that will begin to start using solar energy more regularly. Corporations are already starting to retrofit their office buildings with solar panels and are using new solar shingle roofs on their office towers both to save money and also to take advantage of hefty financial incentives from the states and the Federal government.

The switch to solar energy will also have a big impact on the environment. As people stop depending so much on fossil fuels and focus on living in a more ecologically friendly way the environment will benefit. Solar energy produces far less pollution, no greenhouse gases, and no toxic waste. The environment will be spared from further damage, which will benefit everyone.

Solar power is also becoming a lifestyle. Setting up your home to run on solar energy is a decision to live a different way. It is a decision to break out of conventional modes of living and consuming and instead live in a manner that is better for the Earth. It is a bold statement that says you will live lightly on the Earth and live in a sustainable way. Those who have made the decision to "go solar" are bound by a common cause and have formed societies and communities. Several solar energy societies are national, others local. They can be found on the Internet or through solar power dealers. The solar power societies provide community and expertise for those who have gone solar.