

HEAD of DIVISION (HOD)

SOLAR POWER

**For details, KNOWHOW
& DO-HOW see ExNoRa
RENEWABLE-PEDIA**



Solar Energy Made Easy

Written by

Alaina Wibberly



First of all, you might want to know how solar power works. Solar power is one of the fastest growing alternative energy sources, along with wind energy, geothermal energy, and hydroelectric energy, and it has captured the public's imagination with its potential to lead the green energy revolution.

When most people think of solar power, they think of solar panels that convert sunlight into energy using photovoltaic cells. But solar technology can come in many different forms, and it doesn't have to involve fancy devices. Something as simple as strategically using windows to collect or deflect heat depending on the season is a way we use solar energy every day.

But back to the solar panels. Photovoltaic technology, which converts light into electricity, found its first practical use in space in the 1960s as scientists searched for a way to provide power aboard spaceships. The development of this technology reduced the price (which previously had been unreasonably expensive), and by the 1970s it became feasible as a source of power down on earth as well. Since then, solar technology has exploded and the price has been drastically reduced, making solar a low cost energy option for many people.

So how do I take advantage of solar energy?

Solar energy doesn't have to be expensive.

The most daunting part of switching to solar energy is the up-front cost of purchasing and installing solar panels. For many people, this initial expense simply isn't possible within their budgets. What people don't know, however, is that there are many programs, incentives, grants, and rebate opportunities that can minimize (or even eliminate completely!) the costs of setting up a solar system for your home. Finding these opportunities just takes a little research, so for your convenience, we've compiled a list for you right here:

Some solar companies cover 100% of the installation costs themselves, leaving you with \$0 of initial expenses. While the company continues to own the equipment, you can buy the energy it produces for less than what you would normally pay your utility (and with the knowledge that you're using clean energy). Other companies offer solar panel leasing programs. This is an easy way to avoid paying money out of pocket at the beginning and start getting cheap electricity prices right away. You can check out some of the best residential solar companies [here](#).

The Database of State Incentives for Renewables and Efficiency (<http://www.dsireusa.org/>) has lists of rebate programs, grants, and financial incentives for both homeowners and business owners that make commitments to renewable energy. Just follow the link, enter your state or zip code, and type “solar” into the search bar to see opportunities for funding that can reduce the price of starting up your solar energy system.

The Solar Investment Tax Credit is a policy aimed at promoting clean energy investments on both residential and commercial properties. If you install solar systems in your home, the government will provide a reduction in your federal income taxes. Right now, the residential ITC (Investment Tax Credit) is set at 30%, but this credit will be reduced to 26%, 22%, and subsequently 0% over the next 5 years, so you should take advantage of this opportunity while you can. Learn more about it here:

What if I want the advantages of solar energy, but I don't live in a house where I can install a solar system?

Don't worry, even if you live in an apartment or can't make long-term, permanent changes to your current residence (you may be someone who moves frequently, is renting a home, or just isn't ready for the commitment of a building-wide solar system), you can still take advantage of solar energy. There are a number of portable solar devices that you can attach to windows, railings, or balconies. These won't provide energy to your entire home, but the panels will feed directly into your electrical system to significantly reduce your electric bill by supplementing it with renewable energy.

Smaller-scale options include solar-powered chargers for your electronics and solar panels that will power a variety of appliances and devices. Small, portable electronics like phones and laptops are perfect for these solar chargers since it doesn't take much energy to keep them running.

Fun Facts about Solar Energy

The amount of solar energy that reaches the Earth's surface in one year is double the amount of all non-renewable resources on earth.

As of 2013, a new solar system was installed in the United States every 4 minutes, and 2016 is set to be the biggest year yet for solar growth.

The southwest United States has the greatest solar potential in the country, with parts of California, Arizona, New Mexico, Nevada, and Texas receiving enough sun to power up to 1,600 homes per 100,000 square feet of solar panels. That's just one square foot of solar panel for every 40 square feet of property!

Since solar power began to be taken seriously in the 1970s, the cost of solar energy has gone down by a factor of 150. Solar is now selling for under 4¢/kWh (compare this with the average 12¢/kWh you spend on electricity)!

If you have a solar system installed in your house, you may be producing more electricity than your home needs during peak sunny hours of the day. You can actually sell this extra energy to your utility to make even more money from your solar investment.



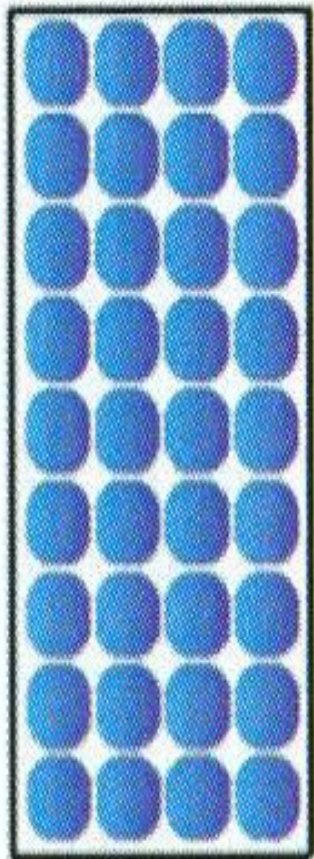


FEATURES

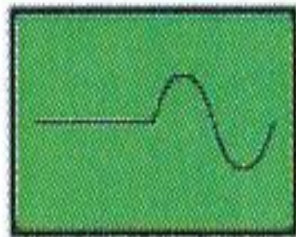
OFF-GRID SOLAR INVERTER & CONTROLLER

- Excellent overload capacity
- intelligent battery management function
- Comprehensive protections





PV Array



Inverter



AC Service Panel



AC Utility Meter



Power Lines







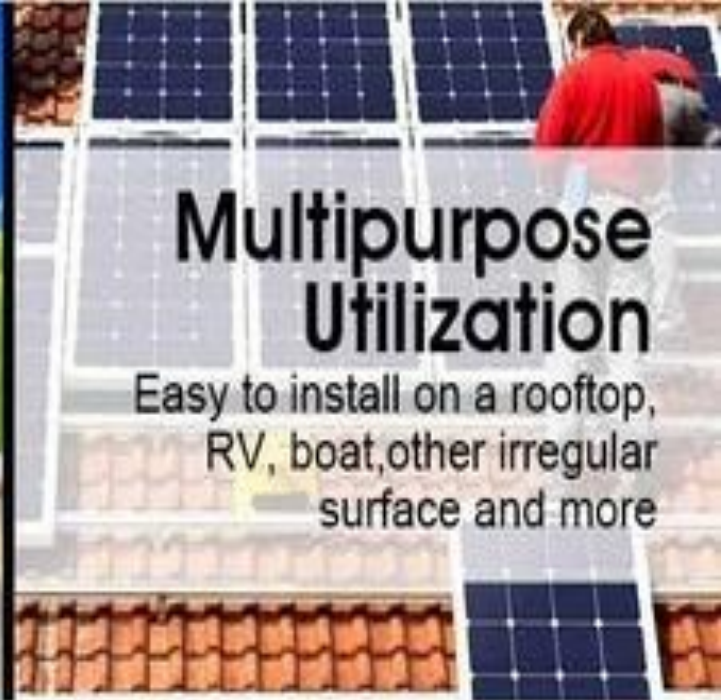
How effective is your solar solution?

With detailed analysis of your utility usage,
solar harvesting and backup power utilization,

YOU can see how well your solution works.







Multipurpose Utilization

Easy to install on a rooftop, RV, boat, other irregular surface and more

Go Greener with Suaoki Solar Panel

Works as a high-efficient 100W solar battery charger in a green way

- 100W
- 17.8V
- 5.62A
- MC4
- 4.0mm²
- MC4
- AM1.5





SolarPanelStore.com
EVERYTHING YOU NEED TO GO SOLAR!

Solar Made Simple

by

Tom Lindberg |

Apr 26, 2017

Solar
made
Simple.





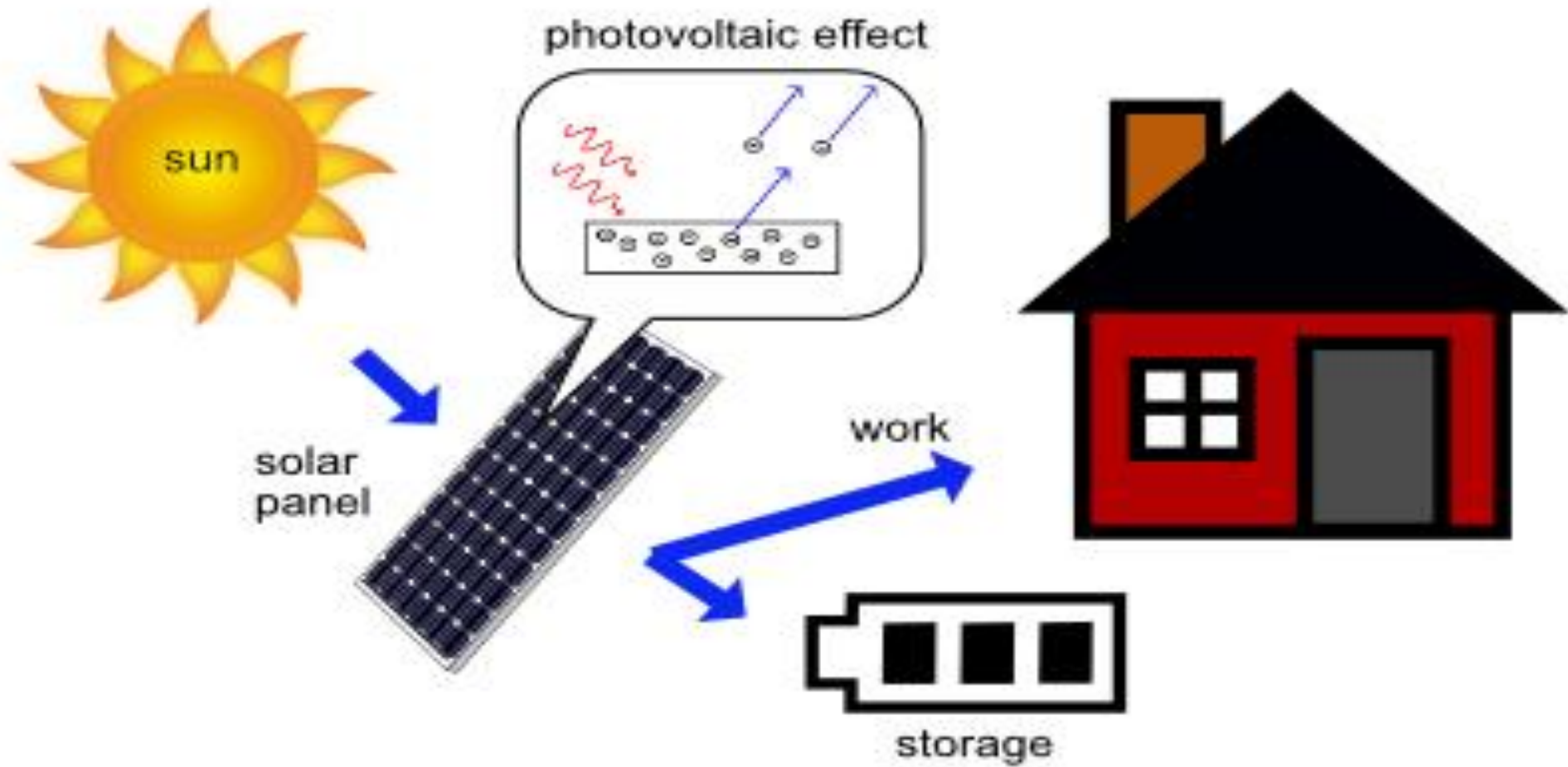
SOLAR MADE SIMPLE



SKYWAY
ELECTRIC & SOLAR

Really? Solar made simple? OK, we admit, solar power can get pretty complex depending on what your goal is. But in this post, we try to simplify the initial important concepts that will help you get up to speed and make better informed decisions on going solar. So where to begin? First off, it helps to define the scope of what we mean by “Solar”. For purposes of this article (and really for purposes of the website and business of SolarPanelStore.com), by “solar” we mean electricity produced from solar energy by way of the photovoltaic effect (or “PV”).

We’ll dig deeper into PV in a later post, but to keep things simple we often just describe our focus as solar electric products or systems. By focusing on PV, we exclude other types of solar energy applications like solar thermal (using the sun to heat water or other fluids circulating in pipes), concentrated solar (utility scale reflecting of sunlight to concentrate heat), wind power (which is really derived from the sun heating the Earth’s atmosphere, which causes wind), etc.



This diagram boils solar electricity down to its core. Of course the devil is in the details for any particular use, but it really helps to understand these principles because they underly all solar projects.

The Sun

This is solar made simple after all, but isn't starting with the sun a little too basic? Well maybe. But seeing solar panels mounted on a north-facing roof tends to change one's mind. There is a lot more to this topic, but to keep it simple, we need sun to make solar electricity. And we'll need collectors, which we'll cover in a minute. But first, the more direct sun on those collectors, the better.

Sunny days. The more sunny days the better. Cloudy, rainy climates mean less sun to make energy.

Longer days. The longer the sun is up, the more energy can be made. So places closer to the equator with longer days mean more solar energy. Same thing with summer days vs. winter days.

Direction. Collectors need to face the sun. In the northern hemisphere, that mean pointing south. As close to south as possible. The more those collectors point other directions (southwest, west, etc) the less direct sun they receive, and the less energy they produce.

Shade. Like clouds, shade is bad for solar energy production. Depending on the equipment chosen, a very small amount of shade may really reduce the amount of energy produced (like a chimney or a branch above a roof). But some equipment can really minimize these losses.

Angle. The optimum angle for maximum energy production varies by latitude and season. It's more complicated than this, but think flat at the equator and steeper as you go north.

Sun and the Panel

The next step in the solar PV chain is to collect the sun's energy keeping the above points in mind. How do we do this? Solar panels of course! "Solar module" is the more correct term, but most people still call them solar panels. A solar panel is really a grouping of solar cells. Those cells are what make up the grid-like pattern you see on a solar panel. You may read or hear about 36, 60 or 72-cell solar panels. Usually, the more cells means a larger panel which produces more energy.

The PV effect creates electricity in each solar cell when the sun's rays contact the silicon in the cell. The electrical current flows through ribbon-like wires that connect the cells within the panel. Those wires exit the solar panel through wire "leads" connected to terminal inside a junction box on the rear of the panel.

There are different types of solar panels. Most commonly used for a multitude of applications are the rigid style made up of silicon solar cells covered by tempered glass with an aluminum frame and an insulating back sheet. There are also "thin-film" style panels that are semi-flexible, plastic-like material that may be glued to a roof or embedded in a device. The composition of the solar cells may also vary and will certainly continue to evolve, but the standard today is silicone-based material.

DC Electricity

So thanks to the miraculous photovoltaic effect, electricity is birthed of sunlight and silicone. Solar made simple. Got it. So you can just plug a TV into the solar panel's outlet and you're good to go right? Not quite. First, the solar panels aren't usually next to a TV (or other appliances) since the best direct sun is often on top of a house or mounted on a pole or rack away from the house. So the electricity generated from that panel needs to be routed to where it can be used. That happens through conductors or "wire" that connects to the leads of each solar panel. Often there is more than one panel involved, which we call an "array" that need to be wired into groups called "strings" in order to match the voltage and current from the array with the right equipment downstream.

But not just any old wire will do. It has to be rated to carry DC current at certain levels at certain temperatures in certain environments (hot roofs vs underground). So what is DC current or electricity? DC is “direct current” electricity. It’s direct because electrons flow in only one direction. It’s also the form that batteries store. But it doesn’t travel long distances well. On the other hand, AC current (“alternating current”) is a form of electricity where the electrons alternate directions and travels over long distances without the losses of DC current. Accordingly, utilities specialize in producing and supplying AC electricity to homes and businesses to power almost everything.

Storage or Work

Once produced and moved from the solar panel, DC electricity must either be stored or put to work. The options really boil down to these:

- Option 1: DC electricity directly connected to power a DC appliance (or “load”)
- Option 2: DC electricity stored in a battery to power a DC appliance later
- Option 3: DC electricity “inverted” or transformed into AC electricity to power AC loads
- Option 4: DC electricity inverted into AC electricity and “sold” back to the utility grid
- Option 5: DC electricity stored in a battery, then later inverted into AC electricity to power AC loads

Option 1 is the most simple, but of limited utility. “PV Direct” systems only supply power while the sun shines. And the loads must be able to handle variable power depending on the strength of the sunlight and shade. Well water pumps and attic fans are typical examples.

Option 2 is the typical system for RVs, boats, and other remote “off-grid” power needs (lighting, remote pumps, instruments, telecom, sensors, etc).

Option 3 & 4 happens in a typical “grid-tied” residential system. The house uses solar energy to power AC loads while the sun shines or sells it back to the grid if not needed.

Option 5 is the most complex scenario and is the system used for off-grid homes, or grid-tied homes with battery back-up systems (a/k/a hybrid systems).

Knowledge is Power

While the sun is certainly power, so is knowledge! Knowing the basics of solar electric systems, you can make better-informed plans and decisions about how to employ solar systems for your project. You can have more efficient phone discussions with us about what are looking to do. You can better evaluate a contractor's proposal. And frankly, you stand a better chance of being happy with the end result.



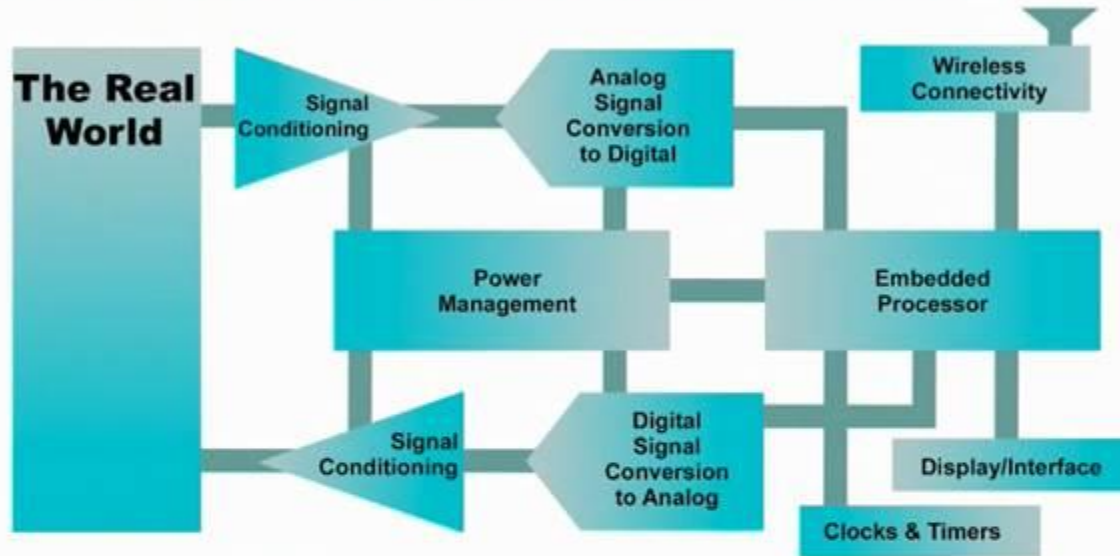
Solar Made Simple.



Wienerberger

solar-made-simple.co.uk

Systems Made Simple



Solar Inverters

Portable Solar 80 W Car Charger



Solar Made Simple

Solar Station

Step-by-step construction plans

By Ben Peterson

Solar power made:

- **Plug-in ready**
- **Multi-use**
- **Simple**
- **Easy**
- **DIY**



600 watt off grid



2000 watt grid tie

Bonus:
2000 watt
Grid Tie Panel
Configuration

SolarStation.com