SOLAR ENERGY UNLEASHED

How to Save Money by Utilizing Solar Power in Your Home!

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Solar Energy Unleashed

Since the dawn of time, man has attempted to harness nature. It's something of an obsession. We've cultivated crops, domesticated animals, built cities, dug up fossil fuels, and even landed on the moon. But, the most common and powerful source of energy at our fingertips has been ignored by many executives and innovators for far too long. Until very recently, solar power has been a passing fad that only the most die-hard of green energy converts and NASA would tout, and yet the technology never died. It continued to develop, to innovate, and to become more efficient.

The first solar cell was created in 1941 by an enterprising American working with silicon named Russell Ohl. It's been 70 years since that first breakthrough, and solar technology has come a long way. Cars have been built with solar cells. Houses have been taken off the energy grid with solar and wind energy sources. You can go out right now and buy your very own solar energy kit and start tapping into that the power of that great big orb in the sky.

With the world realizing with increasing urgency that our traditional energy sources just aren't cutting it any longer, solar is finally coming into its own. This is a soon-to-be multi-billion dollar worldwide industry.

And, with the right tools and knowledge in your back pocket, you can be at the forefront, heating your water, powering your garden lights, or even bumping your entire home off the energy grid once and for all with green energy.

And it all starts with knowledge – the basic facts about how this innovative technology actually works and why you haven't heard nearly enough about it in the last decade as our oil prices have skyrocketed.

It's Not Just Solar Cells

Even if you know nothing about how solar energy works, you've probably heard about or seen those foil-lined, shiny solar cells that sit atop businesses and schools. These photovoltaic (PV) cells are just one form of technology at our fingertips used to convert the sun's rays into a viable form of energy for our homes, electronics and cars.

But, with the right technology, the sun can be used for all sorts of other energy transference. The dream of converting your entire home to solar dependency doesn't have to be out of reach. Ignore the critics that say it's a passing fad or that the savings take too long to manifest.

Other technologies exist that provide opportunities to save money, and there are many methods available to do your part to minimize your carbon footprint. We're talking about:

- Solar hot water
- Solar collectors
- Active solar space heating
- Photovoltaics

And that's just the solar side of things. You can also boost your natural energy sources by utilizing wind power and by cutting back on your current consumption rates. This guide will touch on all of these topics and more as you attempt to learn what it will take to stop using your share of the fossil fuels in the world and cut back to strictly natural, renewable energy.

Wait! Before you read any further, watch the following video that shows you how you can save massive amounts of money off your weekly food bill by growing your own vegetables. You'll also escape the danger of harmful toxins and pesticides as well!

Save money by growing your own organic veggie garden:

http://www.yoursite.com/go/food4wealth

Saving money on your food bill is just as important as cutting your power bills with renewable energy. In fact, you'll probably save more by growing that veggie garden than you ever would by installing solar panels!

Forms of Solar-Powered Energy

Consider the world's current energy sources – not just the oil and coal we use to run our computers and cars, but the food, water and wind around us every day.

It's all because of the sun. Trace the food chain to its lowliest members and you'll find plants and algae – both life forms that can transform the sun's rays into energy sources through photosynthesis. That energy allows plants to reproduce and in turn transfers to the animals and people who eat them. In a sense, then, all energy in your food comes from the sun, even if it goes through five or six steps of the food chain before it gets to your belly.

Even the current forms of energy we use are merely old, super high-density containers for solar energy. Coal is compacted plant matter. Oil is compacted algae matter. And natural gas? That's the by-product of both of them.

It's all a cycle so it's no surprise that technology has developed in recent years to take advantage of the sun's rays in as many ways as possible, not just through silicon-based solar cells, but through solar collectors, insulated tubes and more.

Solar Collectors

First thing's first – how do we take all that energy being pumped out by the sun each day and convert it into viable power for your home?

It's done with solar collectors – special panels that you place in your roof, on your walls, or beside your pool to collect and trap the radiation given off by the sun as a usable source of producing heat. We'll get into the systems used to convert that energy into a form that works in your home soon, but for now, let's take a look at how the collectors actually work.

Sometimes called solar thermal collectors, collectors are used in many installations – most notably solar hot water and space heating setups. They may also be used for solar towers, solar power plants and solar conversion for warehouses or commercial outlets.

Think of it this way: Roughly 52% of all electricity generated in the United States is done with the use of coal. However, coal doesn't generate electricity on its own. Usually, it is burned or broken down in a way that releases energy. That energy is then used to heat water, which turns turbines. Those turbines then produce electricity, and it's stored and transferred to homes and businesses throughout the region.

A solar collector is taking on the same role as the coal – it's trapping energy and preparing it for conversion to a form we can actually use. Where and how you use those collectors will depend largely on what kind of energy you need. Instead of the highly unstable and generally not very useful solar radiation that comes from the sky every day, a solar collector converts the sun's energy into something that can be used to heat water or recharge a battery.

Heating Collectors

The first type of collector is used for heating. Solar heating collectors come in flat plate or evacuated tube collectors. Basically, a flat plate will heat a tank of water, whereas evacuated tubes will transfer heat to various tubes of coolant which can be transferred to a tank for later use. The latter is more often used in commercial settings or for homes that experience freezing winters.

- **Flat Plate** – A flat plate collector is an insulated box that contains a plate designed to absorb solar energy, usually protected beneath a set of glass or plastic layers when installed in your home. If you use the same collector plate for your pool, it may be uncovered.

- **Integral Collector Storage** – The integral collector storage (ICS) system is often known as a batch system because it usually has multiple tubes or tanks contained within a single insulated box. The system will pump cold water into the tubes or tanks to heat it. The water is then transferred to your standard hot water heater, which is heated by gas or electricity.

  This ensures that, if your region freezes in the winter, you always have a source of hot water. The hot water heater can be set to only turn on when the water drops below a certain temperature coming from the collector. In most situations, this reduces your traditional energy use by up to 70%.

- **Evacuated Tube** – The third type of solar collector is the evacuated tube, which encapsulates each pipe in the collector with numerous clear tubes made of glass. Each tube will have metal absorbers to trap the solar energy and heat the water.

  Due to the scalability of this option, it is used often for businesses and large buildings. Another benefit here is that the evacuated tubes are not affected by things like air temperature due to the insulation.

These collector types will vary greatly depending on whether you are installing a heating system, a hot water system or a different thermal solar system.

Electricity Collectors

The collectors you've probably seen more often are the ones used for generating electricity – the panels, dishes, pyramids and towers that dot the landscape in secluded areas or in industrial parks. Different types of collectors include:

- **Parabolic Trough and Dish** – Troughs are used by solar power plants to concentrate the energy collected from the sun to heat a pipe filled with coolant, which is then used to power boilers in a station. Parabolic dishes look like giant foil-wrapped satellite dishes. They focus all of the sunlight received onto a single point where it is converted into a more useful form of energy.

- **Power Tower** – Like something out of a scene in a science fiction movie, the power tower is surrounded by small mirrors that focus on the central point of the tower. The tower then transfers heat gathered to the base of the tower where a power station is located.

- **Solar Pyramid** – A pyramid uses air as the conductor to turn the turbines. They require a lot of space and are covered in solar collectors that transfer heat to the air that is pushed through them.

There are a number of reasons why these systems tend not to show up on your neighbor's roof or at the local grocery store. They're expensive to implement and require a complex system to ensure the mirrors and collectors remain concentrated in the right location throughout the day.

The amount of heat generated and collected, however, is immense. This makes them perfect for power plants where cost can be outweighed by the long-term benefits of a productive power plant.

The biggest issue that keeps concentrating and collecting systems from being used residentially is that they generally don't work in sub-prime conditions. If the sun is invisible or simply diffused for any period of time, they don't work well, whereas photovoltaic systems continue gathering power.

So, instead of focusing on what you *can't* use, let's take a look at how solar collectors can be integrated into your home for thermal collection.

Solar Hot Water

Yes, solar panels are cool. They take the sun's rays and convert them into real-life electricity that can run a toaster or an LCD TV. But, a lesser known use of solar power that is far more affordable and efficient for the average home owner is solar hot water.

So, what makes a solar hot water system so powerful, yet three times more efficient than PV panels? It's the combination of simplicity in design and long-term use with

minimal maintenance. Plus, because of the current tax climate, you can receive massive rebates from the state and federal governments for adopting a green energy source in your home. In short, it will actually pay for itself sometime soon, rather than in 20 years.

Savings and Production

Like any solar energy source, solar hot water will vary in how useful it is for your home, largely depending on how much sunlight you get throughout the year. A well-built system that is large enough for your daily hot water needs and that can store energy throughout the day should be able to provide hot water for your entire home for as many as 8 to 9 months out of the year.

However, if your region freezes often, or if you have 200+ days a year of rain and cloud cover, the sunlight may not cut as deeply into your bill as you might like. You'll want to measure the savings before investing money into a system like this to be sure it will benefit you in the long run.

System Options

Solar hot water has been on the market for about 25 years now, and in that time, quite a few methods have been developed to convert energy from the sun into the hot water you use to take a shower or do your dishes. There are multiple systems to choose from when determining how to install your hot water. Which one you choose may depend on factors such as local rebates, space and the daily hot water needs of your family.

- **Active** – An active system uses various parts and mechanics to absorb heat and transfer it to your household water source.

- **Passive** – A passive system does nothing beyond providing a funnel for solar energy to the water source.

For the most part, the passive systems are easier to install, less expensive and require far less maintenance. On the flip side, if you live in a high-maintenance climate where the sun takes long naps and it gets very cold in the winter, you may need the extra bells and whistles of an active system that can back up your hot water, separate the heating elements and provide on-grid options when conditions get too harsh.

How a Solar Water System Works

Whether you have an active or passive system, you'll need to have a collector and a storage tank for the water. The collector will take in the solar energy, amplifying the heat and transferring the radiation to the water in the tank, which will then be

distributed, either to a secondary storage tank or throughout the hot water pipes in your home.

Ultimately, you have two options for your storage tank – dual tanks or a single tank – and three options for your solar collectors. Here is a quick breakdown of the differences between active and passive systems.

Active Solar Hot Water Systems

In an active hot water system, there will be a number of moving parts that make sure it keeps running under all conditions. This is very important for a home that doesn't get a lot of sun during some parts of the year, or that suffers from deep freezes during the winter. Without an active system, you may lose hot water completely or suffer damage to your installation.

Active solar hot water systems come in two forms – either direct or indirect circulation systems. The direct circulation system will simply heat the water in the collector and move it through your home as it is heated, using a series of pumps. The indirect system will use a special coolant liquid that can be transferred between the solar collector and a heat exchanger which will transfer the heat to the water for later use.

If your home is in a climate where it freezes often, an indirect system is almost vital to avoid any pipes that might freeze in the collector. Imagine having your water backup in the tank attached to your roof freeze. The damage would be incalculable.

Passive Solar Hot Water Systems

In general, these systems are much simpler. They use traditional plumbing and gravity to move water between the solar collectors and your hot water facets, but because they lack any pumps or backup systems to keep things running, you run the risk of a system that will bleed heat and become inefficient quickly.

The first type of passive system is the integral collector, which we already discussed and which is great for homes that are in nice warm climates. However, for those that might encounter freezing temperatures, the thermosyphon system may be a better option. This system works with the natural properties of water to syphon hot water out of the collection system. Cold water will rise into the batch tank, and as it is heated, it will rise in the collector and run into a higher pipe that goes to the hot water heater or storage tank.

This second method is great if you're interested in something reliable and passive, but keep in mind that they generally cost more because of the need for new plumbing and to be very carefully installed – usually by a professional – because they are heavy and attached to your roof.

Is a Solar Hot Water System Right for You?

Hopefully everything above made good sense. Even if the technical details didn't hit home, consider this – a solar hot water system is a great way to cut back on your carbon footprint and reduce your energy bills instantly with a relatively basic installation. Especially if you're using natural gas to heat your hot water tank, this can be a great way to cut your gas bill.

And the cost is very attractive. The parts and installation of the system may seem hefty up front, but you'll almost never need to worry about maintenance and the sun's rays are always free. The cost of parts and labor will vary, but on average, a new home buyer will spend as little as $10 to $15 a month over the course of 30 years to cover the cost of the system, which is generally far less than you'd be paying for hot water for a family of four.

In comparison, it will cost roughly three times that much to install a photovoltaic system that can produce electricity for your entire home. If your heating bill is significantly higher than your electric bill due to the use of natural gas or oil, you may want to consider starting your solar conversion with a hot water or heating system, both of which are far easier to install and have a far lower upfront investment.

Active Solar Space Heating

If you've ever been in a greenhouse, you've been exposed to the basic principles of solar space heating. Instead of concentrating solar energy on a single point or converting it to electricity with expensive photovoltaic cells, you transfer solar energy into your home through a glazed surface – such as glass or plastic – and use the energy for heating.

Of course, it can be much more complicated than that depending on how much heat you want to generate, whether you want to store it or transfer it to other rooms, and how you will use the energy when it is gathered. So, it's a good idea to determine how each of these systems will work in your home before making any decisions.

Passive Heating

Passive solar heating is pretty simple and the least expensive way to introduce solar power to your home. It basically takes advantage of south-facing windows, insulation and sunspaces to gather and hold heat throughout the day to maintain the temperature in your home.

A passive system most commonly uses what is called a direct gain setup to store sunlight throughout the day and then release it over time. This allows the home to stay warm even after the sun has set. The biggest issue here is overheating as there is no way to regulate the heat your building materials gather during the day.

Another common form of passive space heating is called indirect gain. This is when you use special building materials or insulation that will hold heat during the day and then release it into the home. This creates a buffer to reduce the direct heat your living space absorbs, but still maintains the slow release method.

Active Heating

Active heating takes us back to the collectors we discussed earlier. You'll need to gather solar energy in concentrated points and direct that energy through water and other fluids to the rest of the house – sort of like a solar boiler. Air can also be used as an option to transfer the heat throughout your home.

- **Liquid Systems** – A liquid based system will use the same kind of water collector described in discussing hot water systems. Then, with the help of pumps or valves, you will transfer that water throughout the house to radiators, floorboards or walls to redistribute heat to different rooms. It doesn't need to be water – some liquid systems will use various non-toxic coolants as the transfer source.

- **Air Systems** – In an air transfer system, an air collector is used to heat pressurized air that is then distributed throughout the house to keep you warm.

One of the more common additions to a system like this is a backup source that provides heat when you either use up the heat you've generated or the sun isn't shining for a day or two. Backup systems usually require water-based heating as water is easier and safer to store than heated air.

Things to Consider

If you're seriously considering installing a solar space heating system, you'll need to do more than just place larger windows on your house. First, you will need to calculate your current energy usage for heating. How much does it take to keep your family warm throughout the year?

Once you've done that, you need to determine whether or not your home is insulated enough to maintain the heat you generate. Without an outside heating source, you want to retain as much heat as possible. Without insulation and with gaps in windows or doors, a solar system will have a hard time keeping up with the energy demands of your home.

If you plan on using a collector, keep in mind that most homes use more energy in heating than for hot water. You won't be able to use a single collector and storage tank for your heating needs. You may need multiple collectors, either on your roof or in your yard, to ensure you get enough heat during the colder months of the year.

Is Solar Space Heating Worth It?

If you live in an area where heating is necessary for more than a quarter of the year and you get sufficient sunlight to generate that energy, you will definitely benefit from solar space heating. Passive systems are less expensive and require fewer moving parts, but since they can be far less accurate when it comes to providing enough heat for your home, they are generally recommended only for temperate and moderate climates.

If you live in a colder area where it freezes often, you will want to consider an active system that can continuously generate heat and store it for later use. You may also need to remain tapped into an external heat source to ensure you don't run out of viable energy in the dead of winter.

Photovoltaics (PV)

I've saved this solar method for last for good reason. While photovoltaics (or solar cells) may be the most commonly cited and recognizable solar technology, they are also the most expensive and at times hardest to utilize for a residential home. However, when it's a viable option, PV is still a technology that can revolutionize how we use energy in the decades to come.

How Photovoltaics Work

So far, we've discussed other solar systems that basically concentrate solar energy and transfer it to another medium – either water or air. With a photovoltaic cell, things are done electronically. In short, the cell is converting the energy from the sun into electricity using a silicon semiconductor.

It's the same technology we've using for years to power computers, transistors and other electronics, but instead of a man-made power source, we are using the sun directly. When the sun's light hits the PV cell, some of that light is absorbed by a semiconductor made of silicon (or a similar material). The energy in the semiconductor then breaks loose electrons that can travel as they please inside the device.

Once inside, these electrons are pushed in a particular direction, thus creating a current. Once the current has been generated, you can use contacts located on the PV cell to draw electricity off of it to power your devices.

I've just boiled down a very complex subject to about 150 words so you'll have to bear with me when I say it just works. Entire books, classes and college degrees are based on this subject so if you're interested in how electricity, silicon or semiconductors work, there are plenty of introductory resources to draw from.

However, the basic idea is that those PV cells can take the sun's rays and convert them in real time to electricity which we can use to power various devices – from the solar-powered calculator we all thought was amazing in second grade to the space station orbiting the earth with solar panel wings catching as much radiation as possible with each circuit.

Issues with PV Cells

Since the 1950s, photovoltaic cells have been used by various military, government and commercial outfits, and scientists the world over have tried to determine when this technology would become feasible for residential use. When will we all be able to unplug from the grid and start using solar power only?

The problem, unfortunately, isn't the sun. The sun's rays produce 1,000 watts of electricity a day for every square meter of the earth they hit. That's a lot of juice. The problem is the efficiency of the solar cells, which lose quite a bit of power in the transfer, rendering them fairly weak in terms of electricity generation.

Silicon and other conductive materials are also pretty shiny, which means they shoot all sorts of radiation back out, wasting possible energy sources. Up to 2006, the average solar panel only absorbed 15% of the solar radiation that hit it. The goal is 40%.

Of course, new technologies constantly being developed, and some solar panels have been created that can get efficiencies of 41% or higher. But, the cost is high, which makes it tough for a regular guy or gal like you to take full advantage of the technology.

Tapping into the Sun for Your House

With all that in mind, application of solar panels for your home's electricity use isn't necessarily that hard. Once you factor out the cost, you simply need to make sure you have the right angle and direction in which to face your panels. Ideally, solar panels should be angled upwards and should face south in the Northern Hemisphere or north in the Southern Hemisphere, where the sun will spend most of its time throughout the year. If your home's roof faces slightly east or west, you can still use the panels, but expect some efficiency loss.

Next, you need to determine how much electricity you use and how much electricity your system can produce. Since it's impossible to know when the sun will shine, you'll need to use averages provided by the National Weather Service (in the U.S.), or a related agency in your country. These numbers vary but will give you a baseline from which to work.

You will also need to get your average electrical use from your current power provider. It costs roughly $9 per watt of electricity usage to install a solar system. The more watts you use each day, the more solar cells you'll need to power your home. The average home runs on between 100 and 300 watts, but beware – 100 watts of electricity is not very much. If you plan on cutting your electricity use to afford a solar cell system, you'll want to be realistic about how much you can cut.

Another factor many people don't realize is that most states have systems in place that will allow you to remain attached to the power grid. In particularly drab months with no sunlight, you can draw as much power as you need, and in bright and sunny months or when you're on vacation, you can sell power back to the electric or gas company for credit, essentially banking it for later use. You'll need to check with your local government and power provider to find out if it this is an option for your home.

Putting Your Knowledge to Use

So far, we've discussed the details involved in solar systems of various types. But, once you've decided if these systems are right for your home, you'll want to take the leap and install them. The next section will cover in depth what each solar system requires, what it will cost and the long-term energy savings you can expect.

Installing Solar Power in Your Home

For the sake of this report short, we'll review two options you have for installing solar power in your home – collectors and panels. Keep in mind, however, that you can also take advantage of passive heating systems to draw power into your house through special insulation or simple glass windows, details we'll cover in the final section.

Heating Installations

For the simplest heating systems – the ones where you add a few pipes and install a solar collector and tank on your roof, you can likely install it on your own without any help. However, the more advanced closed loop systems require a great deal of alteration to your plumbing and may even require special permits; discuss your solar heating plans with a contractor before starting any new project.

For a solar heating installation, you'll need a variety of parts, depending on what your heating system will be used for.

Solar Collectors

The solar collector will either be a flat panel attached to your main tank or a network of tubes that will run water through to be heated. The actual size of most solar collectors is around 4–8 feet, although some can be as large as 12 feet if you have a particularly large tank.

If you have a lot of cold or rainy weather, you may want to consider evacuated tubes for your collector as they cut down on outside temperature influences – a major factor in the winter. Only the sun's energy will impact the temperature of the water or coolant in your collector this way.

Storage Tanks

A solar storage tank acts as the transitional device between the collectors and your water heater. If you use a closed loop system, the water will be heated in the storage tank by a series of coiled pipes that come from your collector. If you use an open loop system, the water will be pumped directly to the solar collectors for heating and then returned to the hot water tank to be used.

Water Heater

This isn't necessary in an open loop system that is completely disconnected from the grid, but it is highly recommended because you never know when you'll lose the sun or need some extra hot water. A backup hot water heater will remain in service, only producing hot water when your solar tank runs empty or the thermostat drops too low

on the current supply. You can link them up so that hot water from you solar collector goes directly to the hot water heater and then back to your household supply.

Water Pumps

You'll only need a water pump if you opt for an active system that requires the transfer of coolant or water from your solar collector to a separate tank and then to the hot water heater. You'll rarely have to worry about your pump once as they last for 10–20 years and can be powered by any power source in your home – solar or grid-based.

Heat Exchanger

If you have a closed loop system, you'll need a heat exchanger to transfer heat from the solar collector to your cold water supply. This is usually done by running coolant through a series of pipes and back to a solar tank or the hot water heater. Another alternative is to have a pipe wrapped around another pipe, transferring heat to your fresh water as it is transferred to the facet or bathroom.

Controls and Valves

A number of controls and valves are needed for different types of installations. These will help to determine where the water is pumped and when the hot water is collected using a thermostat in your hot water tank.

The isolation valve is used to cut off and isolate your solar tank if there is ever problem, such as a leak, contamination or improper heating. This way, you can cut off the solar-heated water while maintaining a direct line to your hot water tank if needed.

Another valve you may want to use if you have an open loop system that doesn't use pumps or controls is a tempering valve. This will allow you to directly impact how hot the water coming out of your facet is. If your water gets too hot, adjust the tempering valve to add more cold water to the mix and get it right.

Photovoltaic Cell Installation

Once you've determined how much sunlight you receive each year by analyzing meteorological data and your current electricity usage, you can start creating a list of necessary parts, building materials and permits to get your solar project underway.

Adding solar power to your home with PV cells starts with the big question of whether you want to remain hooked up to the grid or not. Each option has its share of drawbacks so be sure to review them carefully.

If you go **off the grid**, you'll almost certainly need to have a generator or battery to supply power when solar energy isn't available. Even if you plan for the worst-case

scenario, you never know when you'll get 30 days of consecutive cloud cover and rain blocking out your power source. Batteries can be quite expensive, however, and they require a lot of maintenance. Solar panels last 30 years or longer, but batteries may only last 2–5 years depending on usage. They are very toxic so they need to be stored and disposed of properly.

If you choose to remain **on the grid**, you will need to do a lot of research to determine what your local laws are and how to follow the power company's regulations. You will likely need special equipment to ensure the power remains compatible and that, if there is a power outage, you don't continue pumping out electricity to dead power lines (this is a huge safety issue).

Either way, you'll need to consider acquiring:

Batteries

If you opt to go off-grid and install batteries, make sure you choose a deep cycle battery made with either lead-acid or nickel-cadmium. These batteries will last longer and match the energy storage and release requirements for a solar power system.

Charge Controller

Additionally, you'll need to purchase a charge controller, which is important in making sure your battery doesn't get drained too fast or overcharged. When the battery is full, it will stop the charging cycle, and when it is drained too low, the controller will stop drawing off the battery to extend battery life. A charge controller will keep your batteries in service by as much as 150% longer than without one.

Inverter

All electricity is not created equally. For this reason, you'll need an inverter to change your direct current (DC) power (created by the solar panels) into alternating current (AC) power (used by your outlets and provided by your electric company). If you remain on the grid, your inverter should also stop the flow of electricity from your home to the power company when the power is out. This will protect any electrical workers from working on live lines. Inverters are sometimes included in PV cell kits or with basic installation packages so check with your contractor before buying a separate inverter.

Generators

For those who want to go completely off-grid, a generator is necessary, even if you have a battery backup. If the power is low and your batteries are starting to lose their charge, you'll need a generator to recharge the batteries or provide emergency power. If your power output suddenly overwhelms the inverters, you will also need a generator to supply backup power.

A good generator should be directly connected to the inverter so that, when you turn on the generator, the inverter immediately recognizes the new power source and switches the entire load to it. Generators come in many options including gasoline, diesel, and gas. Gasoline-powered generators are the most common because they are the least expensive and the easiest to get fuel for.

Assorted Other Parts

While the core parts listed above are very important, there are quite a few other small parts you'll need to complete your installation, including:

- **Wiring** – Varies depending on the size of your system and the number of panels.

- **Grounding Equipment** – A vital safety consideration and is required for all electrical work

- **Overcurrent Protection** – Regulates and protects the power supply from excess current and shortages

- **Junction Boxes** – Protect and preserve your conduits and cables from the elements and other outside factors like bugs or rodents

- **Disconnects** – Shuts down the direct current (DC) from the solar cells (usually mounted outside the house for quick access in the event of an emergency)

Permits

Before you start hammering away at your new solar energy system, contact your local municipality to see if there are any permits required. The odds are that you will need to acquire at least a building permit and possibly additional permits for the installation of a solar system. Heating systems are usually more straightforward, while PV cell systems might require a lot of paperwork, especially if you plan to say connected to the grid.

Also consider what is legal for you to do on your own. Only certain operations may be completed by an unlicensed contractor. If you're planning on running wires and changing how your house connects to the power grid, you're almost certainly going to need an electrician, and an inspector will be required to look at the finished product and sign off on all safety regulations.

The building department is usually your go-to source for permits, but your municipality can vary from the norm, so check first. In the U.S., however, almost all

cities and towns follow the same National Electric Code. Exceptions include New York City and Chicago, which both have their own building codes.

Don't forget, though, that the government wants people using renewable energy and will reward you for your efforts. So if you follow the rules, use the right materials and file all your permits, they'll help you along in the process every step of the way.

Solar Panels

Of course, there will be the solar panels themselves. With recent advances in technology, there are more options for solar panels than ever before, but it is still important to choose panels that fit your budget and the sizing options for your home. It's best to talk with a salesman or contractor who is well-versed in solar panels specifics that will most directly benefit your home.

Other Forms of Natural Energy

Most of this guide has been dedicated to helping you understand what it will take to grab the sun by the horns and corral it for your personal use. I mean, why not? That thing is huge! It feeds the plants, powers our rivers, and dictates our seasons so why not help out our laptops and TVs while it's at it?

But, for those of you still not sure if you can reasonably expect to make it off the power grid with solar panels alone, there are other alternative energy sources you can tap into that are growing in popularity as technology continues to advance.

Wind Power

Remember how our power plants currently work? We burn coal, and it boils water, which creates steam, which turns turbines. Well, wind power cuts out all the middlemen and turns the turbines directly. When those giant blades turn, they cause a generator to produce an electrical current, which is then stored and sent to homes on its gridlines.

Wind power is fantastic in that it doesn't have any pollution, requires no outside resources, and utilizes minimal land, allowing for multiple turbines to be placed together. For your home, how much you can rely on wind will depend on how much of it billows through your region on a regular basis. Without a steady wind source, you won't be able to tap into nature's gusts nearly as well as you would like. For a home that uses about 780 kWh per month of electricity, you would need a wind turbine that can produce between 5–15 kilowatts to reach the 50–90% efficiency.

Another consideration in regards to wind turbines is space. If you live on a small lot or in an urban setting, they're not going to be feasible. Even before considering the building codes, which will likely limit or disallow a noisy turbine, you'll need to find room for it. However, turbines are fantastically effective if you have a great deal of property.

Thermal

Thermal energy is drawn from the heat produced by the earth's core. The heated rocks and water that come up from between those rocks can be tapped into to generate electricity if you live in an area with significant geothermal output.

To effectively tap into geothermal energy residentially, you would need to have a home located near geothermal vents, or you'd need to drill deep into the earth to access those vents. Luckily, this is becoming easier than it once was as drilling

operators are cropping up in the Midwest and beyond to provide such a service on large properties where permits can be granted.

Quite a bit of care needs to be put into accessing geothermal energy. Because of pollution risks and the sheer number of materials needed to create an electrical source, you would need to hire a contractor and have the property space on which to build.

Hydroelectric

Very rarely is a residential space able to tap into hydroelectric power, but it is possible. Hydroelectric power basically harnesses the energy produced by the water as it flows downstream or in tides on the ocean. Most commercial hydro power is produced by dams such as the Grand Coulee in Washington State or the Hoover in Nevada. These dams tap the natural inertia of water traveling downriver and use it to turn turbines that produce large quantities of electricity.

To use hydroelectric power at home you would need a water source and generator that the water could access. This requires access to a river or stream or waterfront property where you can build a device to harness tidal strength. Most residential generators are upwards of 30 feet high so, again, you'll need the property and space on which to build it.

The turbine of a hydro system is fantastically efficient at converting energy in water to electricity so if you're in a rural area or have the space, definitely consider what this type of electricity can offer you.

Cutting Out the Waste with Less Energy Usage

The whole point of renewable energy is to save money and have as small an impact on the earth as possible. And one of the most effective ways to do that won't cost you a dime – in fact, it will save you money. By cutting waste and using less electricity in the first place, you can reduce your electric bill immediately. This can ease the pressure on your budget and also make it far more realistic to install a solar power system in your home that could replace your grid-based power.

To help you cut down your waste, here are some tips to help reduce your carbon footprint and save money on your bill:

1. **Insulation and Windows** – By properly insulating your walls and ceilings, you can reduce your heating costs by 25% or more. This immediately cuts down on how much oil or electricity you use and allows a solar heating system to run far more efficiently. Windows can be equally as wasteful. Consider upgrading to double-glazed windows to minimize heat loss.

2. **Weatherizing** – You can also seal up any cracks or holes on the outside of your home to reduce the heat loss you experience in the winter. Simple caulking and stripping can go a long way, and in some regions, cities and local governments are subsidizing the cost of doing so, even offering huge tax credits to encourage action.

3. **Thermostats and Refrigerators** – Anything that has a thermostat can be adjusted to use less energy. Your refrigerator is a good start as they use a tremendous amount of power. You can buy a smaller one to start with, storing less food over shorter periods of time. You can also turn up the temperature to as high as 37°F (3°C) and your freezer to 3°F (-16°C) – the most efficient temperatures to maintain food safety.

   You water heater thermostat can be turned down as low as 120°F (49°C), plenty hot for showers or washing. Additionally, you can turn your thermostat down in the winter to 68°F (20°C) – plenty warm enough to feel comfortable. The 4-degree difference has a massive impact on energy consumption.

4. **Wash with Cold Water** – Most clothing doesn't need hot water to get clean when adequate detergent is used. Another tip regarding your water use is to avoid using the dishwasher when it's not full. Additionally, turn off the drying cycle. Instead, you can open the dishwasher to let it air dry.

5. **Light Bulbs** – If you're still using old-style incandescent light bulbs, switch today because they waste a LOT of energy. Upgrade to the far more efficient compact fluorescent (CFL) models to cut down on your energy use by 75% and get as many as five years out of each bulb. The cost has dropped quite a bit recently as well to make it far more affordable when replacing the entire home's lighting.

6. **Shower Heads** – Get a low-flow showerhead installed to cut down on how much hot water you pump through it each day. It costs only $25, but the drop off in energy use is tremendous.

7. **Air Conditioning** – Avoid turning on air conditioners unless the temperature gets above 85°F (30°C). When you turn on an air conditioner, turn the thermostat up to 76°F (25°C), and if it has an energy-saver mode, turn it on as well. If you plan on using solar energy, air conditioning can be a huge drain on your batteries.

This list has enough simple suggestion to get you started today, but there are dozens of other things you can do to cut down on your energy use. Turn off lights when you leave the room. Unplug electronics that use power even when not in use. Do things by hand that you don't need electricity for. Spend more time outside and less time in front of the TV. Buy smaller electronics that use less power. Buy appliances with the Energy Star label.

The more money you can save on your electric bill and the further you can reduce your usage, the more affordable and viable a solar power system will be, and the closer you'll be to cutting ties with the power grid once and for all.

Conclusion

Solar power is fantastic. It's free once you've installed everything, it's renewable, and it's out there almost every day of the year. If you live somewhere with plenty of sunshine and dread opening your hefty electric bills, you have every reason to tap into the massive volume of potential energy that comes pouring from the sky every day.

Just imagine the feeling when you first kick that PV cell frame into gear and start running your refrigerator, TV, coffeemaker and everything else in your home off of clean, renewable energy. No more electric bills. No more power outages. No more concerns about the impact you're having on the earth from burning coal.

You might even see your meter running backwards as you send a bit of power back to the electric company. It's all possible, and the technology is ready and becoming more affordable right now. How you use it is entirely up to you.

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http://www.yoursite.com/go/e4e

How to use solar to slash energy bills

http://www.yoursite.com/go/homemadenergy

Save money by growing an organic veggie garden

http://www.yoursite.com/go/food4wealth

Best of luck with your future projects – remember that by applying the tips you've learned in this ebook and those free videos, you will save a lot of money and help the planet!