The **Complete Homeowners' Guide** To **Going Solar**

SOLARPONICS
RENEWABLE ENERGY SYSTEMS
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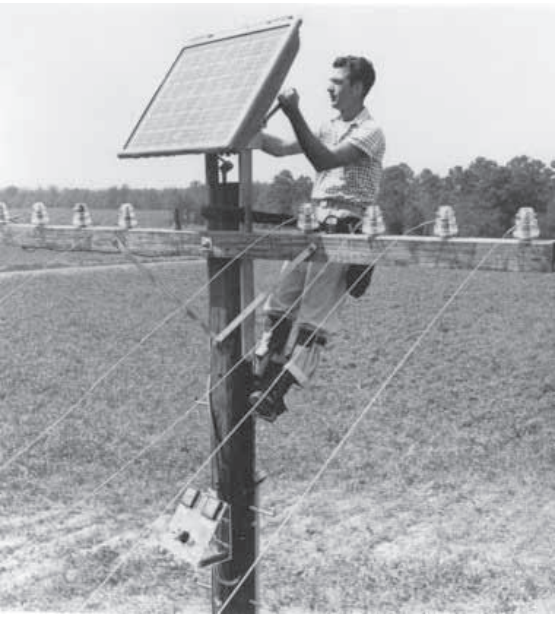
Established 1975.

The Complete Homeowners' Guide To Going Solar

Solar PV has been around for many years, but the complex nature of the technology makes it somewhat daunting for homeowners to understand. From finding the right contractor, to financing, there are dozens of decisions one has to make that can cost the homeowner thousands of dollars more than it should, or save them tens of thousands more over the life of the system.



The solar energy industry is rapidly changing and evolving. The information in this guide is expected to remain relevant through 2016. We expect to release a revised edition for 2017.

The Complete Homeowners' Guide To Going Solar

#1: Intro To Solar Energy

In 1839, Alexandre Edmond Bequerel discovered that certain materials produced small amounts of electric current when exposed to light. Selenium photovoltaic cells (PV) were converting light into electricity at a 1 to 2 percent efficiency. Today, we'e seeing PV panels enter the market that are near 20% efficiency, and lab models producing in excess of 40% efficiency. The typical solar panel that is being installed on rooftops today is about 15% to 17% efficient.

In 1977, solar energy cost about $76/watt. In 1987, the cost had dropped to $10/watt. Today, solar energy costs around $0.50/watt, and is near or at a level we call price parity. In other words, solar energy costs about the same per watt as the low tier utility generated energy. But utility generated energy has multiple tiers. The more you use, the higher rate you pay, and this rate is constantly increasing at a historic average of 6% per year.

Over the last 20 years, California has been home to a number of "world's largest" solar facilities. In 1991, the 354-MW solar thermal SEGS plant (located in the Mojave Desert in San Bernardino County, California) held the title, until being bested by the 392-MW Ivanpah Solar Electric Generating System, a concentrated solar thermal plant located in San Bernardino County near the Nevada border. In 2014, the 550-MWAC Topaz Solar Farm became the new "world's largest operational" solar facility when it went online in Riverside County, California. A second 550-MW facility by First Solar, Desert Sunlight, also went online in Riverside County in 2014. Both of these were superseded, however, by the Solar Star photovoltaic project that went online with 279 MVAC in June 2015 in Antelope Valley, California (located on Los Angeles and Kern counties). While California hosts the three largest photovoltaic facilities in the world (as of July 2015), there are yet several proposals for even larger facilities seeking regulatory approval in California.[1]

California also leads the nation in the number of homes which have solar panels installed, totaling over 230,000. Many were installed because of the Million Solar Roof Initiative. [2]

1. Wesoff, Eric (26 June 2015). "Solar Star, Largest PV Power Plant in the World, Now Operational". Greentech Media. Retrieved 28 July 2015.
2. https://nccleantech.ncsu.edu

#1: Intro To Solar Energy

How does solar energy work?[3] : The sun generates enough energy on our plant's surface in one second to power the entire planet for one year. We can change sunlight into electricity using solar cells. Particles of light, called photons, are captured in a solar cell and produce electrons of direct current or "DC" power. The electrons flow out of the solar cell into an inverter that converts the DC energy into alternating current or "AC" power, the kind of electricity that everything in your home uses.

A net energy meter (NEM) keeps track of all the power that your solar system produces. Any solar energy that you do not immediately consume on site in your home goes back into the grid through the meter.

The three basic components of a solar energy system; the solar panels, the inverter, and the meter. All will be discussed in more detail in a later section.

> **NOTE:** Usually at this point, most homeowners ask, "With such rapid advancements in the industry, is it more beneficial to wait until costs drop further, or for when a newer, better technology comes along"?
>
> Our answer is, "no, it does not serve you to wait."
>
> Why? First, the rapid advancements are taking very small steps forward. The latest and greatest technology is also usually the most expensive, which will increase your payback time. Products on the market today are tried and tested, and designed for optimum return on investment. Remember that the sooner you go solar, the greater your savings are, because you start saving the day your solar energy system is turned on. To wait a year is to give up a year of savings. Additionally, other incentives and tax credits may be available today that will not be available tomorrow. More on that later.

3. http://www.gosolarcalifornia.ca.gov/solar_basics/how.php

#1: Intro To Solar Energy

Why should I go solar now?
If you own your home, have an energy bill of $75 or more, and have roof space, you should go solar. Some of the benefits include:

- Lock in your energy rate at current prices for 20+ years.
- Take advantage of low panel prices.
- Homeowners are still eligible for the 30% Investment tax credit.
- Help reduce greenhouse gas emissions by reducing our need for other fossil fuels.
- Take some of the burden off of our electric generating infrastructure.
- You are making a conscious decision to change the way you live for the better.
- You will save tens of thousands of dollars.
- You are creating jobs and generating a local tax revenue base.
- You are increasing the value of your home by more than the cost of the solar energy system.[4]
- You are helpoing create energy security for our country.
- You will be saving water. Solar power uses less than 1 oz. of water per kWh of energy produced. Coal electric generation uses 140 oz. of water per kWh.[5]

4. http://costofsolar.com/is-my-home-worth-more-with-solar-energy/
5. http://solarenergy.net/News/infographic-world-water-day-go-solar-save-water/

#2: Distributed Generation and Off-Grid vs. Grid-Tied

Distributed generation (DG) refers to electricity that is produced at or near where it is to be used. The term distributed generation distinguishes these systems from the large, centralized power plants that provide the vast majority of the nation's power. Distributed solar energy is usually located on rooftops or ground mounted arrays, and is typically connected to the local utility distributed grid. Distributed Generation also refers to utility-scale solar farms that produce and feed energy into the grid. We will use the term distributed generation as it pertains to residential solar installations.

The benefits of DG are quite simple[6]. In addition to being good for the environment, solar arrays on home rooftops and ground mount arrays in backyards employ local tradespeople to install. The DG model supports local financial markets. DG reduces energy imports, thus decreases the stress on infrastructure, and reduces the need to build as many additional centralized power plants. DG increases tax revenue in local communities. DG takes advantage of unused space. DG makes the entire grid infrastructure more secure, with less reliance on single point s of generation. DG can help meet peak power needs.

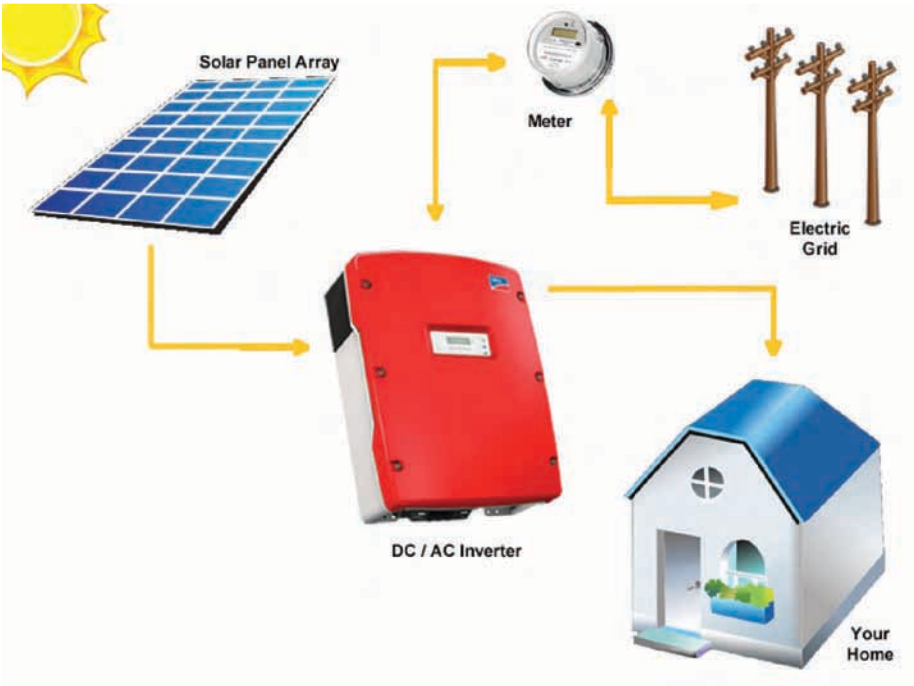
So, now that we understand distributed generation, we can talk about grid-tied vs. off-grid solar energy systems. Simply put, grid-tied solar means a homeowner is still connected to the public utility grid. You still have a meter, still pay a connection fee, and still get a statement every month.

6. http://www.greentechmedia.com/articles/read/RMI-New-Insights-into-the-Real-Value-of-Distributed-Solar
http://pureenergies.com/us/residential-solar/

#2: Distributed Generation and Off-Grid vs. Grid-Tied

Here's how a **grid-tied** solar energy system works:
The sun shines on a solar panel, creating energy. The energy passes through an inverter. Whatever energy is needed by the home at that moment is supplied by the solar energy system directly through the inverter. Any excess that is produced is passed through the smart meter and fed into the grid, for use elsewhere down the transmission lines. In the summer, a home rooftop array will overproduce, sending most of the energy generated into the grid for a credit. At night, when the solar system is not producing, the home draws energy from the grid, using credits. This structure is called **Net Energy Metering** (see part 3).

Grid-tied systems account for 99% of all home solar systems being installed today[7].

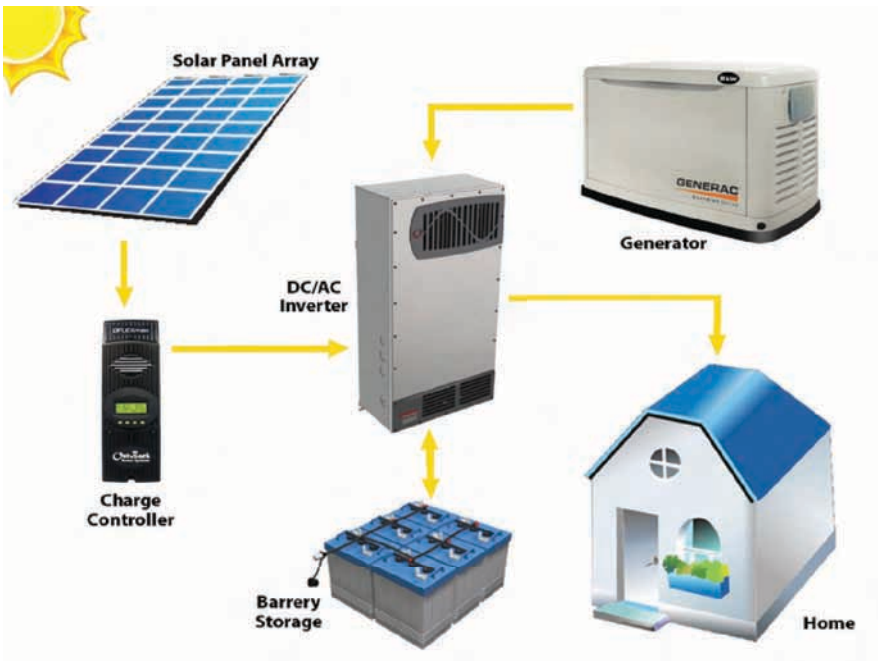


7. http://solarsimplified.org/connecting-to-the-grid/ongrid-offgrid

#2: Distributed Generation and Off-Grid vs. Grid-Tied

Here's how an **off-grid** solar energy system works:
Off-grid means that a home or structure is not connected to the grid. Thus, the structure must have an alternative source of power, enough to cover 100% of the structures energy needs. Since solar panels cannot produce energy at night, an off-grid system requires either the use of a battery storage system and/or a gas-powered generator.

Off-grid systems are most common in remote areas without utility service. The current downside of an off-grid solar energy system with battery storage is the added expense. The battery storage component can add 30-50% more to the cost of the solar energy system.



NOTE: Less than 1% of solar energy installs are off-grid. Off-grid systems are NOT connected to a public utility. This system is good for those who are in remote locations, or want total energy independence, without any support or bill from a public utility entity.

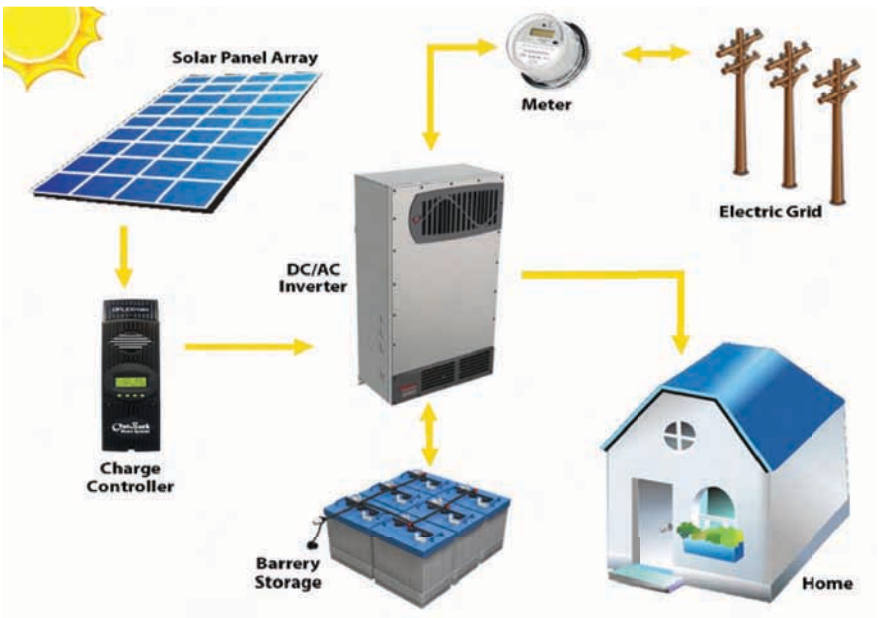
#2: Distributed Generation and Off-Grid vs. Grid-Tied

There is a third type of off-grid system, which is worthy of mentioning.

A Hybrid System. A hybrid system is a grid-tied solar energy system with battery back-up. The batteries store excess energy generated during the day, for use at night, and/or when the power goes out. The structure is still grid-tied, and still able to buy or sell energy through the grid. Hybrid energy systems may also include systems with multiple power sources such as the addition of a wind turbine or gas generator.

The benefit of a hybrid system is that the excess power you are generating gets stored in your battery bank for use by you at a later time. Now, instead of buying back energy when you need it, at possibly a higher rate, you simply draw against your batteries. **Also good for a homeowner who needs a reliable back-up power supply in case the grid fails.**

Hybrid systems are becoming more popular as the utility companies impose more and more fees for solar customers. In California, our Net Energy Metering policy currently states that the utility company issue a net credit for that excess energy. This policy is expected to reach its cap by June 2016, at which time NEM 2.0 will take effect. NEM 2.0 currently proposes that the utility sets the price they pay for your excess energy, and set the price you pay for the energy you will need at night, when your array is not producing **(see Net Energy Metering, part 3)**.



#3: Net Energy Metering

Net Energy Metering (NEM) in California:
Net energy metering, or "NEM", is a special billing arrangement that provides credit to customers with solar PV systems for the full retail value of the electricity their system generates. Under NEM, the customer's electric meter keeps track of how much electricity is consumed, and how much excess electricity is generated by the system and sent back into the electric utility grid. Current California NEM is a watt for watt credit.

A customer on NEM gets a monthly statement, NOT A BILL. The statement shows total energy use and total energy production, as well as any credit due or amount owed.

At the end of a 12-month cycle, the customer gets a "true-up" bill from the utility company. The true-up bill will show a credit or payment due, the difference between how much energy the home used vs. how much it generated, plus all of the connection fees, charges, taxes and what not for the year.

Even a solar energy system that was designed to produce 100% of the homes energy needs will have a true-up bill of approximately $180, which is about $15 month in connection fees, taxes and the what-nots.

An NEM meter is a smart meter. Smart meters are designed to record the amount of energy being used and being generated at your home. The meter provides two-way communication between your home and the utility using secure wireless network technology to communicate usage data to your local utility.

> **NOTE:** NEM has a cap that limits the amount of solar energy installations in MW of installed solar. Once the cap is reached, the current NEM regulations expire. The current NEM policy is estimated to reach its cap and expire by June 2016, at which time, NEM 2.0 will take effect (see next page).

#3: Net Energy Metering

NEM 2.0 was approved by California legislatures. This means that future net metering will preserve retail payments for residential solar. However, the proposal will allow new interconnection costs and non-bypassable charges to NEM 2.0 solar customers. The one-time intercnnection fee could range from $75 to $150 cahrged to the homeowner.
Non-bypassable charges that all utility customers pay equate to about 2 -3 cents per kilowatt-hour of energy used. These charges are used to fund low-income and efficicency programs. Solar cusotmers may have a net zero energy use, and thus do not currently pay non-bypassable charges. The new proposal states that solar customers should pay for non-bypassable charges on all energy they consume from the grid, regardless of the amount of energy they have exported to the grid. This could amount to the 2 -3 cents per kilowatt-hour of energy used from the grid.

The current NEM structure is set to reach its cap by June, 2016, so a new agreement must be reached and approved before that time. All solar installs that are online before the cap is met, are guarantees the original NEM policy for 20 years.

Should You Act Now? YES. NEM 2.0 is not as solar-friendly as NEM 1.0. All solar installs that are online before the cap is met, are guarantees the original NEM policy for 20 years.

#4: Investment Tax Credit

Investment Tax Credit (ITC): Solar consumers are eligible for federal tax incentives for the purchase and installation of eligible solar systems, including both solar photovoltaics (PV) and some solar hot water (solar thermal) systems, as well as other limited renewable energy investments.

This federal tax credit is a one-time credit, but may be carried forward (and possibly back) if not completely useable in the system installation tax year. Rules about carrying forward and backward may vary between residential and commercial tax filers; please consult a tax professional for the current rules.

On December 18, Congress passed a spending package that includes multi-year extensions of solar and wind tax credits, plus one-year extensions for a range of other renewable energy technologies. Under the legislation, the 30% Investment Tax Credit for solar will be extended for another four years. It will then ramp down incrementally thru 2021, and remain at 10% permanently beginning 2022.

History:
Solar tax credits were enacted in 2008 as part of the Emergency Economic Stabilization Act, which included $18 billion in incentives for clean and renewable energy technologies, as well as for energy efficiency improvements. The 2008 legislation extended the solar investment tax credit (ITC) through December 31, 2016 and made other modifications to the tax credits.

Resources:
The IRS current federal tax form for the Investment Credits is Form 3468 is available at www.irs.gov/formspubs

http://www.gosolarcalifornia.ca.gov/consumers/taxcredits.php

#5: Federal, State and Local Policy and Legislation

History: California, with its abundant natural resources, has a long history of support for renewable energy. In 2009, 11.6% of all electricity came from renewable resources such as wind, solar, geothermal, biomass and small hydroelectric facilities. Large hydro plants generated another 9.2 percent of our electricity.[8]

In 2002, California established its Renewables Portfolio Standard (RPS) Program, with the goal of increasing the percentage of renewable energy in the state's electricity mix to 20 percent of retail sales by 2017. The 2003 Integrated Energy Policy Report recommended accelerating that goal to 20 percent by 2010, and The 2004 Energy Report Update further recommended increasing the target to 33 percent by 2020. The state's Energy Action Plan supported this goal. In 2006 under Senate Bill 107, California's 20 percent by 2010 RPS goal was codified. The legislation required retail sellers of electricity to increase renewable energy purchases by at least 1 percent per year with a target of 20 percent renewables by 2010. Publicly owned utilities set their own RPS goals recognizing the intent of the legislature to attain the 20 percent by 2010 target.

On November 17, 2008, Governor Arnold Schwarzenegger signed Executive Order S-14-08 requiring that "...[a]ll retail sellers of electricity shall serve 33 percent of their load with renewable energy by 2020." The following year, Executive Order S-21-09 directed the California Air Resources Board, under its AB 32 authority, to enact regulations to achieve the goal of 33 percent renewables by 2020.

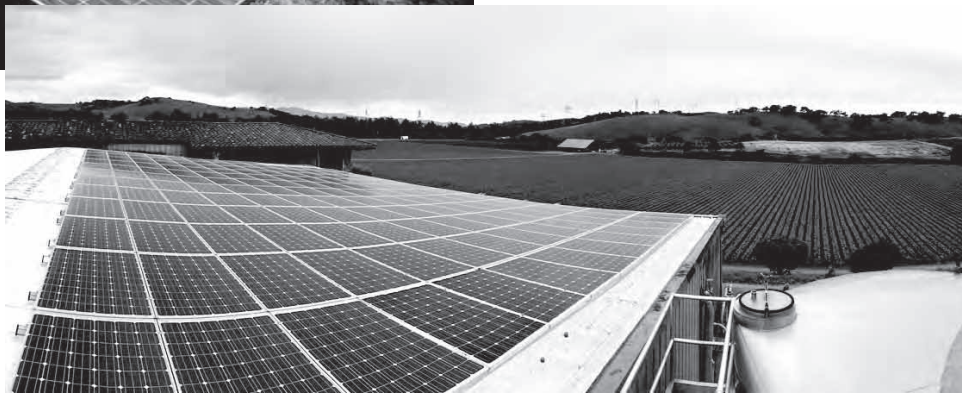
In the ongoing effort to codify the ambitious 33 percent by 2020 goal, SBX1-2 was signed by Governor Edmund G. Brown, Jr., in April 2011. In his signing comments, Governor Brown noted that "This bill will bring many important benefits to California, including stimulating investment in green technologies in the state, creating tens of thousands of new jobs, improving local air quality, promoting energy independence, and reducing greenhouse gas emissions."

This new RPS preempts the California Air Resources Board's 33 percent Renewable Electricity Standard and applies to all electricity retailers in the state including publicly owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators. All of these entities must adopt the new RPS goals of 20 percent of retails sales from renewables by the end of 2013, 25 percent by the end of 2016, and the 33 percent requirement being met by the end of 2020.

8. http://www.energy.ca.gov/renewables/

#5: Federal, State and Local Policy and Legislation

San Luis Obispo County is a solar friendly county. Most municipal city jurisdictions are also very solar friendly. Ordinance No. 3301 was written and approved with the express intent of streamlining the permitting process for residential rooftop solar energy systems. Generally, your local solar contractor will handle all of the permitting process and paperwork for you.[9]



9. http://www.slocounty.ca.gov/search-results?q=solar%20energy

#6: Is My Home Solar Compatible?

Here is a guide to help you determine if your home is a good candidate for solar energy. There are really the three main considerations

1. **Do you own your home?** Yes is the best answer. However, we have installed many projects for owners of rental property.
2. **Is your energy bill above $75?** Again, Yes is the best answer. We have installed many solar systems for homeowners whose energy bill is as low as $45. In these cases becoming more energy independent is the primary goal.
3. **Is your roof south facing?** Yes is the best answer, but East or West facing roofs are still completely viable, just less efficient. There are ways to minimize these inefficiencies.
4. **In lieu of compatible roof space,** do you have a suitable ground area that is not shaded? Rural properties, and homes on a large lot have the option of installing the solar array on a ground-mount system. Ground-mount systems can be optimization for direction, and occupy previously unused space.

Other variables that can affect the design and placement of a solar energy system include potential shading issues from trees, chimney, or vents; roof space and/or roof condition.

Prior to the install of a solar energy system, it is important to look at ways to easily and cost-effectively reduce energy use. Upgrading an old inefficient clothes dryer to a new Energy-Star rated clothes dryer could reduce two solar panels, with the savings more than paying for the new dryer. Thus, a basic energy audit is always beneficial.

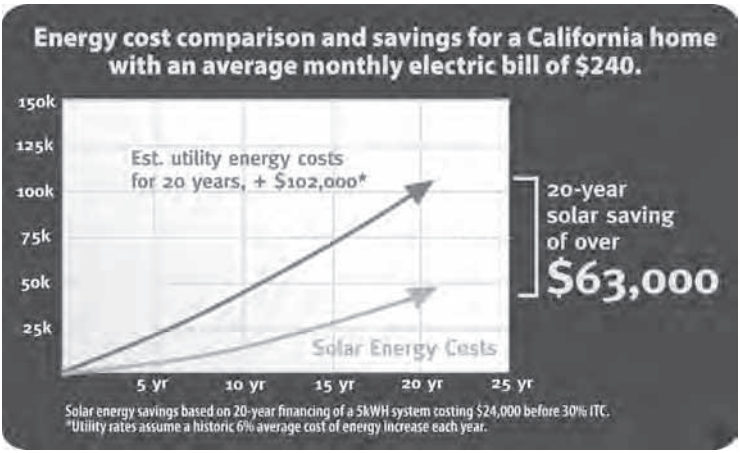
Solarponics' energy audit consists of looking at a full year of energy use. We look at the age and energy efficiency of major appliances, as well as the biggest energy consumer next to your HVAV, the water heater. In more than a few cases, we are able to upgrade an aging water heater to an energy efficient water heater and eliminate two or three solar panels from a proposed solar energy array, for the same cost of solar only.

#7: How Much Can I Save?

This is the part of your solar energy proposal that you should spend the most time on. The difference between a well-designed solar energy system, and a generic solar energy system can be tens of thousands of dollars in savings.

Let's start with the basics. It is your energy use that you are offsetting, not the size of your home, or the size of your roof area. We recommend sizing the solar energy system to produce as close to 100% of your energy needs as possible. By doing so, you are maximizing your investment, and your rate of return. An improperly sized solar energy system could potentially cost you thousands of dollars in lost savings.

If you are considering financing your solar energy system, leasing or signing a Power Purchase Agreement (PPA), it is of paramount importance that you understand the difference in total costs and total savings over the life of the system.



Consider this: On average, California homeowners pay 18¢/watt for energy from the public utility company, with an historic average increase of 6%/year. Solar energy costs less than 11¢/watt, and is fixed at that rate for 20+ years. This amounts to between $44 and $187/month savings during the first year of operation, increasing every year.[10]

The average 20-year savings of a homeowner in California who has gone solar is $34,260.[11]

10. http://www.solar-nation.org/can-switching-to-solar-panels-save-me-money
11. http://cleantechnica.com/2014/02/03/much-can-solar-panels-save/

#8: Purchase Options: Lease, Finance, Buy

Going solar is one thing. Making sure that you maximize your investment to save the most money is quite another. In some cases, solar installers are in the volume game. They want to install as many solar energy systems as possible, as fast as possible. They have learned that a system that can be installed in one day yields the greatest profit. So, oftentimes, systems are designed with this in mind, either under-sizing or oversizing the system to make it a one day install and maximize the installer profit. It is unfortunate, but that is the corporate world we live in.

You want to look for a local installer who will custom design a system to yield the results that YOU want it to yield. Usually those results are saving the most money. So we suggest you look at TWO figures. First, your new monthly out of pocket expense for solar, including any finance payment, interest, and the remaining utility fees. The second number you should look at is your total savings over a 20-year period.

You will find great differences in the types of financing available. Here are some things to consider.

1. CASH. A cash payment yields the greatest rate of return and greatest savings with a rate of return as high as 18% or more.

2. FINANCING. Your rate of return can still be as high as 10% to 12% even after paying a 6% interest rate. In the financing category, there are different loan types.

A. Home Equity Line of Credit (HELOC).
Currently low rates, available thru your local credit union, bank or financial lender.
GOOD FOR A HOMEOWNER WHO:

- can take advantage of the 30% federal tax credit
- doesn't want to add any reported debt
- has equity in their home
- wants to take advantage of the historically low interest rates
- wants the flexibility of interest only payment or prepayment without penalty

B. Green Loans.
Solar Energy Green Loans are renewable energy and efficiency loan administered by a community bank or credit union. Traditionally classified as an unsecured loan, but the default rate is much lower, allowing for better terms and greater savings.

#8: Purchase Options: Lease, Finance, Buy

B. Green Loans continued

BENEFITS:

- Eligible for the 30% federal Tax Credit
- Interest may be tax deductible
- Available with ANY panel manufacturer and equipment
- Greatest flexibility of terms and equipment option(s)

GOOD FOR A HOMEOWNER WHO:

- can take advantage of the 30% federal tax credit
- does not want to take out a second mortgage, but wants a lower interest rate than an unsecured loan offers. A green loan must be used for qualified energy efficient upgrades only, which includes solar electric

C. Property Assessed Clean Energy (PACE). Property assessed clean energy, or PACE, financing allows property owners to fund energy efficiency, water efficiency and renewable energy projects including solar PV with little or no up-front costs. With PACE, residential and commercial property owners living within a participating district can finance up to 100% of their project and pay it back over time as a voluntary property tax assessment through their existing property tax.

BENEFITS:

- Eligible for the 30% federal Tax Credit
- No credit checks
- 100% Financing
- No Banks
- No Added Debt
- May be Tax Deductible
- Fast & Simple Approval
- Easily Transferrable If Property Is Sold.

GOOD FOR A HOMEOWNER WHO:

- wants greater solar savings than a lease offers
- wants to OWN their solar energy system
- doesn't have great credit
- MAY sell their home in the next 20 years
- wants the added benefit of deducting the interest on the solar financing (consult your tax advisor).

CAUTION: Read your lease carefully. Approach with caution.

Reference: Why a Solar Lease May Not Be Good For a Homeowner. http://wapo.st/1ZyNbxZ
Are Solar Leases Actually Bad For Homeowners? http://bit.ly/1mZkdpb

#8: Purchase Options: Lease, Finance, Buy

D. emPOWER Central Coast. (Available in select counties in California only)
This is a program that is a financing partnership with a local bank or credit union and the California Energy Commission. It is an easy to qualify unsecured loan that allows the homeowner to install multiple energy saving upgrades with one manageable monthly payment.
BENEFITS:

- Making your home more comfortable, efficient and safe just got easier. emPower provide a variety of services that includes rebates up to $6,500, low interest financing, free expert energy advice, personalized
- Upgrade outdated Equipment
- Solar energy system is eligible for the 30% Federal Tax Credit

GOOD FOR A HOMEWOWNER WHO:

- has a grossly energy inefficient home that needs multiple energy saving upgrades. Multiple upgrades can be financed together
- doesn't have great credit and cannot qualify for other unsecured loan.

3. LEASE. The main practical distinction between buying and leasing a solar PV system is in ownership. If you buy a solar panel system, you own the system, either outright (if purchasing with cash) or after repaying your solar loan. When you lease the system or sign a power purchase agreement (PPA), a third party owns the solar panel system. This distinction impacts the cost, maintenance, terms, financial offsets, and savings/returns on investment. With a lease, you pay a fixed monthly "rent" to the solar provider for use of the system. With a PPA, you pay a fixed rate per kWh for the power generated.

BENEFITS:

- You don't need a good credit rating to qualify
- You only pay for the energy that the system generates.

GOOD FOR A HOMEWOWNER WHO:

- Does not plan on selling the home for the duration of the lease.
- Does not have good enough credit to qualify for financing.

DOWNSIDE: The homeowner does not get the 30% investment tax credit.
A solar lease or PPA is the most expensive way to add solar to your roof. While you may still save money each month over your current energy bill, most of your savings will go to the leasing company. A lease may also come with an escalator, which allows your lease payment to increase from 1-3% each year, further reducing your savings.

#9: Choosing A Solar Contractor

Choosing a solar installation contractor is a lot like searching for and choosing any other home contractor. Basically, that consists of doing a little bit of homework on your part. Here are the top 8 tips that almost all industry insiders agree on.

1. Recommendations. Beyond just asking a neighbor, "who did you use for your install", ask more important questions like, was the project on budget, on time, as planned, was installation clean, was the crew professional, etc… Check multiple online review sites, not just one source.

2. Meet face to face. Is your salesperson focused on educating or selling? You want a salesperson who has your best interest in mind, not theirs. Also, an in-person visit to your home insures that the contractor knows the condition of your roof, your current shading issues, roof venting, access issues, condition of your breaker box, etc…These things cannot be asssed via Google Earth. Also, does your salesperson know who will be installing the system? Or will it be a sub-contracted crew from out-of-town?

3. Get more than one quote. Hand in hand with this is, do not be pressured into signing the first quote you get, or any quote until you feel comfortable, informed and ready. The Department of Energy recommends that you use a LOCAL solar contractor.

4. Don't let price be your only guide. Lowest bid is not what you want when placing a mini power plant on your roof. Contractors do not work for free, so other corners are being cut to get the price so low. If one quote is considerably more than another, the contractor should be able to communicate why their price is so high. A high price MAY come with actual added value. A number of possible reasons come to mind; quality of service, quality of installation, quality of equipment, service, warranty, trust, etc… Lastly, when comparing quotes, make sure you are comparing apples to apples. The size of the system in kW DC, equivalent panels, warranties, service, savings, etc. It is not what the system costs, but what the system will save you over its lifetime.

5. Know your equipment. Anyone can say anything about a product. We all want to believe that American-made panels are great, and all Chinese-made panels are poor. The fact is, there are inferior American-made panels and superior-made foreign panels. Same with inverters. Solar panels fall in three main categories, like most all other manufactured products; economy, standard and premium. You're not buying a sofa. The quality of your panels will invariably dictate the rate of return on your investment. Select the highest quality panels you can afford for your needs. The increase in reliability and efficiency will more than pay for itself.

6. Financing: Your solar contractor can be a key resource in the type of financing that is available to you. However, you must always be your own advocate. Make sure you are doing what is right for you. Do not settle or be pressured into one type of financing that the contractor offers. Know your total cost of installation and financing, NOT just your adjusted new monthly payment.

#9: Choosing A Solar Contractor

7. Experience. The solar industry saw the single largest increase in contractors entering the market in 2008, the same year as the Energy Improvement and Extension Act was passed, with dozens of contractors joining the list every day. Having said that, experience is not entirely based on the number of years a company has been in the business. I know of companies that have been around for 50 years, in spite of the low quality work and service they perform. I can say this, the more time we spend on rooftops, the more we learn. Even with over 5,000 solar energy installs, we still encounter unique situations, but have the experience to know what to do and not to do. We suggest your contractor have at least 500 installs under their belt, with a crew lead that has at least four years of solar experience with that company.

8. Service: Does your solar energy install contractor fully service the systems they install? Most all systems will promise a 10-year and 25-year warranty. It is important to know who will be performing the service if and when needed. This is where a local company can potentially be a huge advantage. Certainly it is not optimum that your solar install contractor be located 100 or more miles from your location. Local service also goes hand in hand with experience. The more experienced your solar contractor is, the less likely you are to need service in the first place.

#10: Choosing the Right Solar Panels

First off, we recommend that your solar installer choose the right panels for your needs. Having said that, you will need to know a little something about the panels your contractor is recommending.

Almost 90% of the world's photovolaics are manufactured using on some variation of silicon. The more perfectly aligned the silicon molecules are, the better the solar cell will be at converting solar energy into electricity. All solar panel frames are made of aluminum. All solar cells are encased in glass. All of the quality of these components will vary, and will affect the performance and reliability of the panel. Let's look at each component.

The frame. All solar panel frames are made of aluminum. The main difference we have noticed here is the precision of the corners and screws. The quality and thickness of the aluminum frame itself can have a structural impact on the panels' lifespan. A more rigid panel will be less likely to bend, sag or break.

The glass. There are two types of glass used for solar panel frames; tempered and plate. Tempered glass is what most automotive glass is. Solar panel tempered glass is also clearer, allowing higher energy conversion. Plate glass is found in cheap panels and may cloud over time, decreasing the efficiency of the panel.

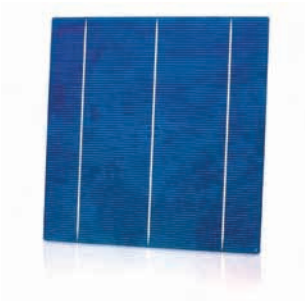
Solar panel color. Typically, monocrystalline solar cells are a dark black color, and the corners of the cells are usually missing. Polycrystalline solar cells are identified by their signature light and dark blue color, and non uniform structure. Both monocrystalline and polychristalline solar panels can have a black aluminum frame, or an uncoated silver aluminum frame color. Color as a matter of appearance and aesthetics can be a major factor in choosing a solar panel manufacturer, but it should not be the primary factor.

Monocrystalline solar cells are quite easy to recognize by an external even coloring and uniform look, indicating a high-purity silicon. Polycrystalline solar cells look irregular, and can be in full sheets, not contained cells as you see in monocrystalline panels.

#10: Choosing the Right Solar Panels

Monocrystaline panels tend to perform better than similarly rated polycrystalline solar panels and because of their higher efficiency, and are slightly more expensive. More efficient panels means less roof space is needed, so monocrystalline panels are good for limited roof area and worth the premium. The downside of monocrystaline panels is if a portion of a panel is covered in shade, dirt, or leaves, the entire string (or circuit) drops production. The use of micro-inverters can solve this problem. **See Part 11: Inverters.**

Polycrystalline solar cells. The first solar panels based on polycrystalline silicon, which also is known as polysilicon (p-Si) and multi-crystalline silicon (mc-Si), were introduced to the market in 1981 Raw silicon is melted and poured into a mold, which is cooled and cut into square wafers. Generally, polycrystalline solar cells are slightly less efficient, requiring a greater area to produce the same energy. The advantage is that they are more affordable.



#10: Choosing the Right Solar Panels

Top solar panel manufacturers. Solar panel manufacturers that have been in the game for many years, weathered downturns, are financially secure, deliver a good product, and have great warranty service, are limited. Having knowledge and experience with the manufacturers can make a good solar contractor a great solar contractor. We visit the manufacturing facilities in person in many cases so we can see for ourselves the level of quality and service the manufacturer delivers.

Our Top Ranked Panels for 2016 based on panel quality, price, reliability, durability, efficiency, degredation, availability and warranty service:

Premium – Both LG and SolarWorld score the highest with consumer ratings.
• **LG Solar:** LG Solar brings world-class engineering and 50 years of experience as a global pioneer in electronics technology. LG panels are as beautiful as they are durable and efficient.
• **SolarWorld;** SolarWorld's Sunmodule panels are designed and manufactured to the highest standards of quality, performance and durability. SolarWorld also has the advantage of being made in Hillsboro, Oregon, USA.

Standard:
• **Kyocera:** Kyocera is the world's largest vertically-integrated producers and suppliers of solar panels. Kyocera has a US-based subsidiary located in Scottsdale, AZ, that served North America. Established in 1975, Kyocera has produced over 7 million modules.
• **Canadian Solar:** Although relatively still a young company, Canadian solar has established itself as a reliable manufacturer of quality solar products that it sells to customers in 50 countries.

Economy:
• **RenaSola:** Renasola offers a range of mono and polycrystalline solar panels. RenaSolar panels have a high output and are amongst the most efficient on the market today. RenaSola is active in 19 countries and is well positioned for continued growth not only in the solar panel market, but also in LED lighting solutions.
• **Trina Solar:** Trina Solar has expanded from its roots as an installation company to become one of the largest manufacturers in the world. They currently hold 575 patents relating to solar.

Summary: An experienced solar energy analyst will pair your needs and energy goals with the right panel that will save you the most money. It is your job to find the right, experienced, trusted contractor. Read your contract. Ask questions.

#11: Inverters

Since your panels produce energy in DC, and your home runs on AC, the power inverter is the heart and brains of your solar energy system. Most homes only need a single inverter that is the go-between the solar array, the home and the grid. The larger the solar array gets, the more inverters that are needed. Adding battery-backup and energy storage to a system adds another dimension to the function of the inverter.

Your solar energy installer will worry about things like inverter sizing, stacking, battery interface, charge controllers, load ratings, wiring requirements, shut-offs, monitoring, etc… This is a specialized area that benefits from the expertise of an in-house system designer.

There are good inverter manufacturers and not-so-good inverter manufacturers. Some inverters work better with some panels than others. The more solar experience a solar install contractor has, it is safe to say the more knowledge and experience he or she has about solar inverters. Selecting a properly sized and matched inverter will deliver a better performing system. Here are a few that we have used for many years and have found to be very capable;

SMA - As a leading global specialist for photovoltaic system technology, SMA is setting the standards today for the decentralized and renewable energy supply of tomorrow. More than 5,000 SMA employees in 21 countries have devoted themselves to this task. SMA Inverters claim a 96% or greater efficiency rating, and maximum service life.

SolarEdge - The SolarEdge inverter combines sophisticated digital control technology with efficient power conversion architecture to achieve superior solar power harvesting and best-in-class reliability. SolarEdge inverters have built-in module-level monitoring receiver and carry a 12-year warranty.

Enphase – Enphase products are designed to deliver more power, but also with less need for maintenance and repairs. Our state-of-the-art testing facility is tough on our equipment, so we know it will stand up to the test of time. Enphase microinverters get more power from the same solar panels. This means greater savings for you. Each microinverter connects to a single solar panel so, unlike other types of inverters, if there is a dirty, shaded or problem panel, the rest of the system keeps running smoothly.

OutBack Power – OutBack Power inverter/chargers have a reputation of delivering superior product performance for remote off-grid power systems. With the recent introduction of the Radian Series Inverter/Charger, OutBack now offers an ideal solution for advanced Grid/Hybrid applications and full flexibility for grid-interactive and off-grid installations.

#12: Signing The Contract

Know what you are getting. It is not enough to simply know that your system will produce 5kWh of energy. Brands and model type of panels and inverters are important, and can vary widely in price, quality and performance, as we have seen. Also, system size should be listed in AC. The AC output will be a lower figure than a DC output. That is because there is a loss in conversion from DC to AC. A contractor should not show you a proposal with an AC kWh figure. This is misleading, as it makes the system appear larger than it really is.

Know what you are paying, not just in a monthly payment amount, but over the life of the system, whether you pay cash, finance or lease. We present our customers with three options that all address their wants and needs, and vary in equipment and cost from premium to economy. With each option, the homeowner can see what his or her out-of-pocket is, the rate of return, as well as the total investment over time. Look at your new monthly payment, payment terms, and total payments at end of term.

> **NOTE:** Understand that you will still have a statement due from your public utility, even if your system is designed to produce 100% of your energy needs.

What you see is what you get. Make sure that everything that was promised in the "sell" is included in the contract. Trenching, if you need it to run conduit, should be included. But if the contractor hits rock while trenching, or other unknown obstacles, there may very well be an adder.

Escalator or fixed Price for a PPA: Over the term of the PPA there will be a fixed or escalating price. For example, it could be set at 3% each year. If there is a price escalator then you want to understand whether it is monthly, annually or bi-annually.

Operations and Maintenance: If the system comes with monitoring, knowing who is responsible for this is very important. Typically, if your system stops producing for whatever reason, you are responsible to notify the appropriate parties, and are NOT entitled to lost energy compensation.

Incentives and Rebates: Before you sign, make sure that you fully understand your costs and opportunities regarding the ITC, rebates, or other incentives. We advise you to contact your tax professional.

#12: Signing The Contract

Payment Schedule: Understand what you will owe and when. Oftentimes a deposit is required before the job starts, with future payments due at installation milestones.

Property Sale: Know your options if you have to move at any time during the course of your financing, lease agreement or PPA. Some leases carry a lien on the property.

Schedule: It is always a good idea to know the timeframe of the install. Solar energy installs take about 10-12 weeks on average from start to finish. However, if you sign with a contractor who is overbooked, your wait could be up to 6-months or longer.

3-Day Right To cancel: Of course, you have three days to cancel the contract for any reason after you sign.

#13: Production Schedule: How Long Will Install Take

A solar energy install generally takes about 10-12 weeks from start to completion.

First, a project designer designs your system. This includes drawings of your roof, electrical components, pitch, setbacks, extrusions, etc… The system is designed around your roof, angle, position to sun, and your energy needs. Additionally, an experienced designer will take into effect the aesthetics of the design from the roof position to ground-level perspective. Typically the technical drawing of your system will not be too far off from the proposal you saw before signing your contract, so there are no surprises here.

Once complete, you should be presented with a plan that shows the size, placement, and position of your system, including electrical runs, inverter(s), and tie-in. Once you approve the design, your permit and design is submitted to the building & planning office.

Once approved by the planning office, your system equipment is ordered. Upon arrival of equipment, your job is scheduled for install. Depending on the size and complexity, your install could take from one day to a week or longer.

Once installed, your system gets inspected and either passes or needs some adjustments based on the inspectors findings. Once it passes, a Permission To Operate (PTO) is filed with the utility company. The utility company has 30 days to review and approve. Once your PTO is approved, we flip the switch, and you begin generating your own solar energy.

> **Note:** Ask what your install schedule is, and what happens if that schedule needs adjusting. Some contractors are small and overbook, pushing installs out 6-months or longer. Even a few months of lost solar energy production can cost you several hundred dollars or more in energy savings.

On the next page, see example fig. 1, is our sample production expectation form. We created this to help homeowners understand the process with more certainty, and understand the timeline. It is also a sort of promise on our part to follow their project through in a timely and responsible manner.

(example fig. 1)

What To Expect in 6-Steps

The following information is your guide to the step-by-step process of a Solarponics solar energy install. If at any point you have questions or comments, you will know exactly who to contact. Total install time for a solar energy system is about 14 weeks to inter-connection.

STEP 1: PROJECT IMPLEMENTATION – Within one week of signed contract

Initial deposit is due at contract signing. PG&E paperwork is started. Financing documents, as necessary, are started and/or completed. You will receive a complete copy of all signed documents and contract via Email within one week.

STEP 2: DESIGN SITE VISIT – Within two weeks after step 1

A project designer makes a site visit to gather technical data and perform a visual inspection of the building, sub panel, roof condition, shading issues, access, etc.

STEP 3: ENGINEERING AND PERMITS – Within four weeks after step 2*

35% payment is due. Invoice is emailed. In-house system design and engineering begins. All concerns and/or changes, if any, are addressed at this stage. Final design layout is presented to customer for approval. Once approved, Solarponics submits the building permits to the city or county. Permits can take up to two weeks to get approval. Install date is set. Panels and inverters are ordered. *Status of loan document approval(s) could delay completion of step 4.

STEP 4: EQUIPMENT DELIVERY & INSTALLATION – Up to four weeks after step 3*

50% payment is due. Invoice is emailed Solarponics employs our own certified install crews for complete accountability and trust. Our crews are responsible, courteous, timely and safe. Lead Installers: Caleb S, Serafin O., Troy S., Ben F. *Ground mount systems and installs in Monterey County or Solvang may take up to eight weeks..

STEP 5: FINAL APPROVALS – Within two weeks after step 4

Final payment is due after final inspection. Our inspection technician meets you onsite with a city or county inspector to review and approve the final install. Once signed off, your customer advocate will then schedule to meet and present your Owner's Manual, review system components, warranty information, new PG&E billing structure and collect final payment.

STEP 6: UTILITY INTER-CONNECTION – Up to 45 days after step 5

PG&E has 30 business days to approve the inter-connection.

Your system is now complete and you are generating clean, renewable energy!

Your Solarponics consumer advocate is:

Customer Signature Date Solarponics Signature Date

Customer Contact Email

#14: Warranty & Maintenance

Once your utility has issued a PTO, your billing structure changes. See Net Energy Metering, Part 3. As there are no moving parts, a solar energy system is very reliable and does not require much maintenance. Having said that, there are some important things to understand about your solar energy system even BEFORE you purchase.

If you decide to lease a system, you will be told that all service and maintenance is covered under the terms of the lease. This IS NOT TRUE. Warranty issues are covered. Maintenance is not. Read your lease agreement closely.

Warranty coverage: Nearly all of the solar panel manufacturers that we have researched offer a 25-year panel performance warranty. These performance warranties guarantee that the panel will perform within a certain efficiency that decreases over time, for 25 years. Most manufacturers guarantee at least 80% output at year 20. Inverters typically come with a 10-year or 12-year warranty. Warranty for workmanship varies. Typically, your roof warranty should be a minimum of five years, and can be as long as ten years.

Solar panels really are built to last and are not the component that is most likely to fail. This is because the PV technology results in very little breakdown of the materials over time, much like transistors and computer chips. However, solar panels are the components most susceptible to damage from hail, hurricanes and other weather born threats.

So what is maintenance? Solar panels get dirty. Dirty panels can reduce efficiency by 15% or more. In dusty areas, it is a good idea to wash off your solar panels as needed. It is also a good idea to make sure that trees do not grow and shade part of your array. We also recommend that you occasionally check and clean your inverter fan, to make sure there are no obstructions or debris build-up. Loose wire connections are also a major cause of system disruption. This is mostly the cause of inferior installation quality. And although the service call to trouble-shoot and correct a loose wire problem should be covered under a warranty, the lost energy generation, your lost savings, are not covered. All of these maintenance suggestions will keep your system in top working condition, and potentially reduce failure and/or warranty issues.

#15: Monitoring

Monitoring: Solar energy monitoring is the process of connecting your inverter to cloud-based software that aggregates and organizes large amounts of performance data, making it easy to monitor the performance of systems. The data is typically available via an app on a smartphone or tablet (fig. 1). Monitoring systems will either require an on-site internet connection at the location or use a cell-based connection.

Whether or not you want monitoring should be a decision you should discuss with your solar install contractor. System monitoring may require special equipment and system design upfront. It is also important to understand the costs of monitoring vs. the benefits.

Customers who do not have system monitoring can easily check the status of their solar energy system by simply looking at the display on the inverter (fig. 2).

fig. 1

fig. 2

#16: You're Online. Now What.

Once your utility has issued a PTO, your billing structure changes.
See Net Energy Metering, Part 3.

As there are no moving parts, a solar energy system is very reliable and does not require much maintenance. If you live in a rural, dusty area, it is recommended that you inspect your solar array for a buildup of dust, and wash the panels clean with water and a mild window-cleaning solution, or specialty solar panel solution. Dirty panels can affect energy production by as much as 30%.

You will want to periodically check your inverter to make sure it is operating efficiently, making sure the fan is clear, and there is also no build up of debris around the vented areas.

We also recommend that you read your energy statement every month, and look for any anomalies in your energy production vs. usage. Aside from weekly or daily monitoring, your statement is your best guide to system performance and your energy use.

Production Output: Residential solar panels are designed to produce upwards of 95% in the first 10 years, and degrade slowly. Most panels are guaranteed to produce at least 80% of their stated production levels for 25 years.

Buying an Electric Car: If you know you will be buying an electric vehicle at some point in the near future, you should discuss this with your installer and size your solar panel system accordingly, accounting for the increased future electric usage. The same goes for any appliances that are huge energy hogs, like a spa, second refridgerator, or second AC unit.

Adding panels after the fact. It is possible, but not ideal, to add panels to your system at a later date after the initial install. There are two main considerations here aside from the added cost. First is the size of your inverter. The inverter needs to be sized appropriately for the system that you currently have for maximum efficiency. Typically you may be able to add two panels and still be within the operational range of the existing inverter. Second, the new panels will need to be the same make and model, and sourcing these panels may be difficult.

Equipment Replacement: Your inverter should last at least ten years or more. You will most likely have to replace the inverter before year 15.

Good luck on your journey to greater energy independence.

#17: Frequently Asked Questions

How much does a solar electric system cost?
The cost of your solar investment will vary greatly depending on the size of the system, your location and available incentives. The average cost is around $20,000 for a home with an energy bill of $200/month. It is better to understand payback time, which is averaging 5 years.

Can my electric bill really be $0?
Your charges for energy use can be $0, but you will still have connection fees and utility taxes.

What incentives are available to me?
Purchases are eligible for the U.S. 30% federal tax credit. Additional state, local and utility incentives exist in some areas, further lowering the net cost of your investment. No other incentives or rebates are available to homeowners in California.

Do I get paid for my extra energy production?
Currently, most of America is under a system known as Net Metering, which allows your net electricity costs to be reduced to zero, but no further. In a select few places in the U.S., you can be paid for any excess electricity you create, in what is known as a Feed-In Tariff system. But you will be paid a very low, wholesale rate.

Can I install solar panels myself?
It is not recommended. The process requires both licensed electrical and roofing skills to ensure the solar power system is safe and optimally designed for 25+ years of production.

How does a solar system affect my roof integrity?
With proper design and installation following industry best practices, your roof should maintain all its pre-solar integrity. Be sure to ask your installer about any guarantees they offer on their installation quality.

Is solar a viable option in cold climates?
Yes. A general rule of thumb is that if you can clearly see your solar panels, they can produce electricity. In fact, given equal sunlight, a solar panel on a cold day will out-produce a solar panel on a hot day.

How does snow affect a solar system's performance?
While snow will decrease production while it is on your panels, it should not damage your system when designed and installed properly. Given the angle of the panels and their tendency to produce some heat, the snow will fall off your panels faster than it would fall off your roof, quickly returning your system to its full potential.

How do solar systems fair in extreme weather conditions?
That depends on the quality of the manufacturer. SolarWorld Sunmodule solar panels can withstand high wind and snow loads. In fact, they are rated higher than any other solar panels under UL standards.

Will my system still generate power during a blackout?
For the safety of workers attempting to fix power outages, solar systems that are connected to the electrical grid are required by utility regulations to shut off during blackouts

#17: Frequently Asked Questions

Can I take my home off the electrical grid?
Yes, provided you install optional battery-backup systems to provide power when your demands exceed your production, such as at night. Batteries add significant costs to your system, extending your payback period. But staying connected to the grid ensures you will rarely ever be without power, unlike batteries that have a limited lifespan and storage capacity.

Can my HOA or neighbors prevent me from installing a solar system?
In most cases, no. According to DESIRE (Datsbase of State Incentives For Renewable Efficiency), "HOA's are barred from restricting a homeowner's rights to install solar panels. California has laws that override any HOA contracts seeking to deny the right to install solar PV systems.

I don't plan on being in my home for 25 years. Why would I add solar?
People move more frequently now than ever before, but that shouldn't impact your solar decision. A solar system can save you money today and even pay for itself in as little as five years. Even if you move before your solar investment is completely paid off, studies show the cost will likely be returned in added value to your home. Plus, your home will most likely sell faster.

Will adding solar energy raise my property taxes?
People move more frequently now than ever before, but that shouldn't impact your solar decision. A solar system can save you money today and even pay for itself in as little as five years. Even if you move before your solar investment is completely paid off, studies show the cost

Will a solar system work on cloudy days?
Yes, though they will be less efficient. A heavy fog day in San Francisco can drop efficiency by up to 80%.

How can I tell if my system is producing?
If you have monitoring set up, simply log in to your account to see what current production is. If you do not have monitoring, you can simply look for a green light on your inverter, indicating the system is operating correctly. Additionally, most inverters have a small display screen that will show you current production. Your smart meter will also be an indication of solar energy production.

How heavy is a solar panel?
The average solar panel weighs about 45lbs. and is roughly 65" x 40", consisting of 72 cells.

Where can I learn about solar companies in my area?
http://www.gosolarcalifornia.ca.gov/csi/step2.php
www.homeadvisor.com
National Solar Database - http://www.seia.org/research-resources/national-solar-database
www.mysolarinstaller.com
www.AngiesList.com
www.solar-estimate.org

The Complete Homeowners' Guide To Going Solar

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About Solarponics.
Solarponics was founded in 1975 by Cal Poly engineering graduate, Mike Emrich, holding the title of the oldest, continuously operating solar energy company in California. The company has grown from 12 to 40 employees since 2012, when Kristian Emrich took over the day-to-day duties of President, COO. Mike Emrich continues to serve Solarponics as chairman and CFO.

Solarponics was voted Green Business of the Year in 2012, Atascadero Business of the Year in 2014, and Pacific Coast Business Times Family-Owned Business of the Year in 2015. Solarponics wrote and lobbied for the resolution to proclaim June 21st "Solar Energy Day" in San Luis Obispo County in 2014. Employees are regular guest visitors in local classrooms from the 2nd grade thru 12th grade and at Cuesta College. Solarponics has participated in two Solarize programs sponsored by the Community Environmental Council, and is currently participating in the emPower Central Coast Program, supporting and encouraging home energy efficiency and energy reduction county-wide. For more information, contact Frank Scotti at (805) 466-5595.

To date, Solarponics has installed over 5,ooo renewable energy systems for Central Coast California homeowners and business owners. Solarponics specialize in solar water heating, solar pool heating, radiant heating, wind energy, battery storage and back-up systems, DIY kits and solar electric systems for residential and commercial projects. Solarponics can be reached at (805) 466-5595, at www.solarponics.com or via email to kristian@solarponics.com.

About Frank Scotti
Mr. Scotti is an award-winning marketing professional with 25-years of experience. He has worked at several global ad agencies including Ogilvy & Mather, Leo Burnett, J. Walter Thompson, BBDO, and Asatsu. His past clients include; Allstate, American Express, CNN International, Coca-Cola, IBM, Lexus, Morgan Stanley, Marines, Phillip Morris, Proctor & Gamble, and Royal Carribian Cruises, Ltd., to name a few. His began working with Solarponics in 2008, through Whizbang, their marketing agency of record. During the next four years, Mr. Scotti saw the unprecedented potential for growth of renewable energy and joined Solarponics full-time in 2012.

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