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Re: Marketing –Solar Panels – Article #1 – **Is Solar Power Worth It?**

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### Scope of Work

Ecousa has contracted with Galvin and Associates to write ten articles on the benefits of solar.

This is the first in the series: Is Solar Power Worth It? 921 WORDS

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### Solar Energy: Is It Worth It?

You've heard it a million times by now: solar power is the answer to the world's energy needs. The benefits – reduced greenhouse emissions, reduced reliance on polluting fossil fuels and foreign oil imports – have taken on added urgency as the world faces increasing climate change. Since the sun will continue to shine for at least the next 6.5 billion years, producing 20,000 times more power than the world currently uses, it's a good bet that solar power will be the answer to the earth's power needs in the long term.

But for the average homeowner, the question remains: Is solar worth the cost for me? This article will look at the pros and cons of installing solar at your home.

#### Your location

Solar power depends on access to sunlight. Virtually any location outside of the polar icecaps can take advantage of solar power – the country with the highest solar power capacity in the world is Germany, in northern Europe.

The exact location of your home and its orientation to the sun can be a factor. If natural features of your surroundings block the sun, you're out of luck. If the blockage is due to overhanging trees, you'll simply need to trim back shade and open up your roof to sunlight.

A workaround that is increasingly popular is shared solar. In areas where homeowners do not have the open access to sunlight necessary for good solar power generation, "Community Solar Gardens" are an innovative answer – homeowners in an area pool resources and get power from solar arrays in a sunny ground setting, without actually having panels on their roofs.

#### Your Roof

Solar panels can be roof-mounted or ground-mounted, but most homeowners look first to roof mounts. Two questions arise:

1) *Is my roof area large enough to accommodate the number of panels I need?*

While you probably have a rough idea of your roof measurements, you'll want to check with a builder to determine the usable area of your roof. A solar installation rep or a calculator on a solar energy website will give you information on the number of panels you'll need to meet your power usage.

2) *Can my roof handle the weight of solar panels?*

Most modern homes have framing strong enough to handle the weight of solar panels, which are much lighter than they were 10 years ago. To be sure, have a builder take a look-see at your roof framing to calculate the exact weight load the framing is able to handle.

#### Your Current Energy Costs

Electricity and gas are one of the biggest bills for a homeowner. While costs can dip during periods of very mild weather, your utility bill is always a significant cost.



Most homeowners dramatically reduce their utility bills by going solar. On average, adding solar panels to a home saves \$100 or more per month. In areas where net metering and feed-in tariffs are available, homeowners actually sell or receive credits from the utility company for their excess power.

### **Your Utility Company**

Some –but not all– utility companies offer “net metering” or “power purchase agreements, terms for an agreement between you and the utility in which the utility gives you credit for any excess electricity your home’s solar system generates. With net metering, your electric meter actually runs backwards!

Check with utility company to determine if, and what kind, of agreements they offer for your excess power: it can mean big savings for you.

### **Government Support**

Federal and State governments provide rebates for homeowners (and for utility companies). Federal tax credits of 30% of cost can significantly reduce the investment necessary for a homeowner purchasing his/her own solar system. Additional grants and rebates are typically available at the State level – check with your State energy office.

### **Equipment Costs**

Now, the big one: paying for your solar energy panels and installation.

The best solar panels are expensive to produce, since they are made with rare materials like cadmium telluride and copper indium gallium selenide. The costs of good solar panels, the ancillary equipment and installation can run tens of thousands of dollars. Traditionally, a homeowner needed 10 years or more before the savings from solar paid off the equipment and installation costs.

Today, most homeowners choose leasing or power purchase agreements. With leases and PPAs, the solar company provides the solar panels at little to no cost. In return, the solar company actually owns your solar panels and equipment and leases them back to you. The solar company also gains whatever financial advantages come from government rebates and utility credits.

For the homeowner, leasing is a simple answer: no big upfront costs, and saving money from the first day.

### **Maintenance**

Clean your solar panels several times a year – that’s it. Solar panel manufacturers typically offer 20- to 25-year warranties.

### **Summary**

As you can see, there are locations and situations where solar are not possible for a homeowner – wrong geographic location or home orientation, poor roof structure or design – and situations where solar is less desirable – local utilities that do not offer net metering or PPAs, solar suppliers that do not offer leases. Government estimates indicate that 20% of homeowners fit that description.

However, 80% of homeowners have the right location, the right roof, availability of government and utility credits and access to leasing as an option for financing a solar installation.

Find out if you fit into the 80% and take another look at your utility bill. Then ask yourself: when am I going to go solar?

## Solar: How Much Can You Save on your Electricity Bill?

How much can you save with solar? The question is simple enough, but the answer depends on how much electricity you use each month and the rates your utility charges, since both factors vary from home to home and state to state.

### Your Usage May Vary

The folks down the street with the hot tub, and the guy next door with the woodworking shop in his basement – they use more for electricity than you do. If they go solar, they will save more dollars than you, since their electricity bill is larger than yours. But not to fret, you and your energy-hog neighbors will save about the same percentage off your respective electricity bills.

### Utility Rates Vary

In Nevada – lots of air conditioning – the average solar household saves \$145 per month; in Utah, one state over, average solar savings are \$87 a month. Residents of Alaska, at \$270 a month, save the most; Nebraskans, at \$35 a month, save the least.

The national average solar savings is \$84 a month, which comes to \$1,008 for the year. If you go solar and save \$84 a month off your current bill, you will save \$20,160 over the 20 years of peak production from your installed solar system.

### Calculating Solar Savings – Quick Answer

While rates may vary, you can get a rough estimate of your savings by simply deducting your solar electricity from your utility electricity bill. The average American solar household gets 80 percent of its energy from solar and 20 percent from the utility. So here's the quickest way to figure your savings:

- 1) Take the amount you spent on electricity last year (your utility company may show that on your January bill; otherwise, add up your monthly totals)
- 2) Take 20 percent of the total – that's the amount you will still be paying to the utility
- 3) Subtract that 20 percent from the total – that's the amount you will be saving with solar

### Calculating Solar Savings – Month-by-month Answer

As every homeowner knows, electricity usage fluctuates every month. You can use the 80/20 formula to calculate each month but it won't be accurate: utility rates have "tiers" where you pay a higher rate when you use more kWh (kilowatts/hour) during specific times of day.

Fortunately, many utilities have gotten on the solar bandwagon and provide solar savings calculators on their websites. If your utility does, all you have to do is input your zip code, since the utility already has their rates installed in the calculator and can input your usage history. Their data will show the 20 percent you'll pay them, the 80 percent you'll generate through solar, and your savings by month and for the year.

If your utility is not so solar friendly, there are a number of websites that provide the same information for free (some require your email address so they can pitch their services). In these cases, input your zip code, utility company, and total usage in kWh, and they will use a solar calculator to give you a pretty accurate estimate of your cost and savings per month and per year.

### You May be Selling Electricity

You may be able to sell extra electricity to the utility company. Many – but not all – utility companies offer "net metering," which means purchase agreements with homeowners in which

the utility buys your excess electricity. If your utility does, you will earn additional dollars by supplying electricity to the grid. Since you are generating excess electricity, your electric meter actually runs backwards!

If you are selling energy to the utility, your savings will increase, most dramatically during the sunniest months of the year. Naturally, homes in mild sunny climates will generate the most excess energy but even in Northern states, you can expect to earn money from excess electricity at least three months a year.

### **Calculating Solar Savings – Net Savings Answer**

Any calculation of solar savings must consider your costs to install the system in the first place. If you are financing the installation through your bank or credit union, you will need to subtract your financing costs. Likewise, if you have a lease or a Power Purchase agreement, you will deduct those costs to know your true net savings.

### **Calculating Solar Savings – Don't Forget the Environment**

One of the great benefits of solar is that even while you're saving money, you're also helping save the environment. A solar system generating 7,700 kWh per year will reduce CO2 air pollution by over 4,000 pounds a year – the equivalent of driving a gasoline-powered car 10,240 miles.

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This is the third in the series: Types of Solar Panels 804 WORDS

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## **Solar Power Systems: Types of Solar Panels**

You're thinking about going solar, so you need to know just how these things work. For instance, what are the different types of solar panels?

Photovoltaic (PV) solar panels are the devices you most commonly see on solar homes in your neighborhood. Solar panels have tiny cells that absorb the sun's rays and convert the energy of light particles into electrical energy.

Where solar panels differ is in the method they use to make that conversion from sunlight to an electric current.

While the technology of translating the sun's rays into electricity can be quite complex, the choices you will encounter involve three primary types of photovoltaic (PV) solar energy generating panels: Monocrystalline, polycrystalline and thin film solar panels.

All three panel types use silicon crystals as basic building blocks. They differ in the purity of their silicon crystals. Since higher purity translates into superior conversion of sunlight to electricity, you can compare panels based on their "efficiency."

Each type has benefits and downsides – you'll need to choose the one best for you.

### **Monocrystalline Photovoltaic Solar Panels**

Monocrystalline solar cells are made out of silicon ingots that are cut into wafers. When you look at a solar panel, you can recognize a monocrystalline type because its wafers are evenly rectangular, with no rounded edges.

*Benefits of Monocrystalline Solar Panels:*

- Best Purity – made out of the highest-grade silicon
- Highest Efficiency – best at translating sun energy into electricity of any solar panel type; typically 15-20%, up to four times the efficiency of thin-film panels
- Best in Low Light – higher-efficiency monocrystalline panels are better at capturing sunlight on overcast and low-light conditions than other types
- Space Efficiency – since monocrystalline panels are the most efficient, you need fewer panels
- Longevity – monocrystalline panels continue to produce at a higher efficiency level than other panel types; but this may not be a major consideration, since most manufacturers provide a 25-year warranty

*Downsides of Monocrystalline Solar Panels:*

- Most Expensive – monocrystalline panels are typically more expensive than other types
- Performance Suffers on Hot Days – monocrystalline panels work less well when they become overly warm
- Performance Suffers when They're Dirty – monocrystalline panels with a central-string inverter break down when even one panel is covered in dirt, snow or shade. The workaround is to get a monocrystalline panel with a micro-inverter, so the remaining panels continue to work

**Polycrystalline Photovoltaic Solar Panels**

Polycrystalline panels use a different manufacturing method. Instead of cutting individual silicon crystals, these cells are created by melting raw silicon and pouring it into a mold to create a perfectly square wafer. You can recognize a polycrystalline solar panel by its speckled blue wafer color.

*Benefits of Polycrystalline Solar Panels:*

- Less Expensive – the process of manufacturing polycrystalline wafers is simpler and has less waste than monocrystalline manufacturing
- More Heat-tolerant – polycrystalline panels are less susceptible to high-heat conditions

*Downsides of Polycrystalline Solar Panels:*

- Less Efficient – polycrystalline solar cells are less pure than Monocrystalline cells, with a typical efficiency of 13 to 16 percent
- Need More Square Footage – since polycrystalline solar panels are less efficient, you'll need more panels to generate the same amount of electricity

**Thin-Film Photovoltaic Solar Panels**

Thin-film photovoltaic cells (TFPV) are manufactured in yet another way: a thin film of silicon or other energy-absorbing material (cadmium telluride, copper indium gallium selenide, et al) is applied to a substrate – the manufacturing equivalent of adding jelly to your toast.

*Benefits of Thin-Film Solar Panels:*

- Least Expensive – while low cost is not a given for thin-film solar panels, the manufacturing process is simpler and potentially less expensive than crystalline-based solar cells
- Look Great – thin-film solar panels have an even, homogenous look that is aesthetically appealing
- Less Sensitive to the Environment – Shade and high temperatures have less impact on thin-film panels
- Can be Flexible – since the solar-sensitive film is applied to a substrate, that substrate can take a variety of shapes, which opens up a host of potential panel shapes and sizes

*Downsides of Thin-Film Solar Panels:*

- Much Less Efficient – current thin-film solar panels have efficiencies of 7-13 percent, with an average of 9 percent, so are less efficient than monocrystalline or polycrystalline panels. As manufacturing processes improve, thin-film panel efficiency is expected to rise to 10-15 percent
- Last Less Long - thin-film solar panels tend to degrade faster than mono- and polycrystalline panels, and thus typically have a shorter warranty
- Need Much More Square Footage – lower efficiency means you'll need a lot of space; typically, four times as much space as you'd use with monocrystalline panels. You'll also need more collateral equipment, in the way of cables and support structures
- More Appropriate for Commercial Applications – thin-film solar panels, in their current form, can make economic sense for agricultural and industrial uses. Until they improve in efficiency, they are generally not a good choice for residential.

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This is the fourth in the series: How Solar Panels Work 325 WORDS

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## How Solar Panels Work

If you're considering solar, you will find solar panel and installation companies touting the advantages of their solar technology. While there are indeed differences in solar panels, all of them share the same basic science of converting sunlight into electrical power. Here is a basic explanation of how solar panels work.

### Particles, not Rays

We typically describe sunlight as rays and for everyday discussion, that description is correct. However, when we talk solar energy, we are talking about sunlight on the molecular level. Now we find that a ray of sun is composed of tiny particles, called photons. Each photon carries a small dose of energy. The trick is to capture the photon and translate its energy into an electrical current.

### Turning Sunlight into Electricity

Solar panels are made with small wafers of a conducting material, typically silicon (some panels, notably thin-film PV panels, may use cadmium telluride, copper indium gallium selenide and other light-reactive substances). When the sunlight's photons come in contact with the panel's cells, the photons knock loose electrons in the wafer's light-sensitive substance.

If you remember your high school science classes, electrons have a negative charge, and will be attracted to a positive charge. What the photovoltaic cell does is attract those loose electrons in a specific direction. Get enough of these electrons streaming along and you have a current: Voila! You now have electricity.

### Measuring a Panel's Ability to Convert Sun to Electricity

There are different types of solar panels, and are described by the materials used to capture sunlight: monocrystalline wafers, polycrystalline wafers, and thin-film photovoltaic. Each of them transforms the sun's photons into an electrical current. How well they do it is called "efficiency."

At the high end, solar panels convert 20 percent of the photons; at the low end, about nine percent. As solar technology progresses, panels are able to convert ever-increasing percentages of sunlight into solar power, and at an ever-declining cost.

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## ARE HIGH EFFICIENCY SOLAR PANELS WORTH THE COST?

With many competing solar brands, you'll hear that the most efficient panels are the best. While that sounds good, how do you know which brand is best and more important, which one is best for you?

### Efficiency explained

In the world of solar, "efficiency" refers to the ability of the wafers on a solar panel to absorb sunlight and convert the sun's energy into electricity. Among currently available panels, the most efficient ones convert 20 percent; at the low end are panels that convert nine percent.

### Benefits of Efficient Solar Panels

The most efficient solar panels work well because their wafers –the rectangles or squares you see on the panel– are made from high quality materials in a very precise manufacturing process. In most cases, the material used in the highest efficiency panels is silicon, and the silicon crystals are actually sliced and shaped into rectangles.

These highly efficient "monocrystalline" solar panels provide the most energy per panel. On the face of it, that makes them the best value. You'll need fewer solar panels on your roof to generate the electricity you need.

However, "value" means the most for the money, and monocrystalline solar panels are generally more expensive than other types of solar panels. If you have a limited area for your solar panels, monocrystalline panels are necessary; but what if you have a large roof area? Would you get a better value by buying less expensive polycrystalline panels that generate at something like 15 percent efficiency?

### You Need a Formula

The best way to compare apples-to-apples value in solar panels is to know the cost-per-watt. After all, it's electricity you're after, and electricity is measured in watts.

The formula is simple: take the amount of power in watts that a particular model generates and divide it by the price of the panel. The answer will be your price-per-watt.

Of the top ten-selling solar panels on the market today, the price-per-panel (for a purchase of 25 panels, the size of a residential system capable of generating 5 to 6 kilowatts) ranges from \$183 to \$262. The price-per-watt ranges from \$.075 to \$0.99.

As you might have guessed, the more expensive panels use monocrystalline wafers; the less expensive use polycrystalline.

### Comparing Solar Electricity Cost to your Utility Cost

If you look at your utility bill, it will tell you your electricity costs in "kWh", which stands for kilowatt-hours. Across the U.S., utilities charge on average 8 to 17 cents per kWh.

To compare your prospective solar system cost to your current utility rates, get your solar company account rep to quote you how many kilowatt-hours the system is expected to generate during its lifetime, which typically means the 20 years it is under warranty. Take that total kilowatt-hours and divide it by the cost of the system and you will have how much you are paying per

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kilowatt-hour; divide that number by 100 and you'll have your cost in cents, and really know how your solar system stacks up against the utility.

**So... Are High-Efficiency Solar Panels Worth the Cost?**

Unless you like the bragging rights of having the most efficient, state-of-the-art technology, or have a roof with limited space available for your solar system installation, you should purchase the system that gives you the best value – and it will probably be something less than the most efficient.

But hey, the idea here is to make a good decision and then forget about it for 20 years – and just enjoy saving money every month by going solar!

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