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February 13, 2015

Susan Bitter Smith, Chairman
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

ORIGINAL

Re: Chairman Bitter Smith Request for Comments
Solar Distributed Generation Business Models and Practices and Their Impacts
E-00000J-14-0415

Dear Chairman Bitter Smith:

APS appreciates the opportunity to provide these initial comments regarding the business models, practices, and impacts of the Distributed Generation market. Under the Commission's leadership, APS has led the advancement of solar energy in Arizona since 1954. Today, over 881 MWs of solar capacity is installed on APS's system, and Arizona has more solar energy installed per capita than any other state. APS is proud of its solar achievements, and looks forward to ensuring the long-term success of solar under the Commission's direction. Your letter and this docket are part of that effort and represent the next chapter of the Commission's solar leadership.

I. The Solar Industry Has Changed Since the Commission's Last Full Examination in 2010.

In 2010, the Commission considered the nature of the rooftop solar for the first time in Docket No. E-20690A-09-0346.[1] At that time, the Commission considered whether rooftop solar companies acted as public service corporations when they provided rooftop solar to schools, government facilities, and non-profits under Solar Service Agreements (SSAs). In Decision No. 71795, the Commission declared that they were not:

[1] *See* In the Matter of the Application of SolarCity Corporation for a Determination that when it Provides Solar Service To Arizona Schools, Governments, and Non-Profit Entities, it is Not Acting as a Public Service Corporation Pursuant to Article Section 2 of the Arizona Constitution, Docket No. E-20690A-09-0346.

> "Based on the facts of this case, SolarCity is not acting as a public service corporation when it provides electric service to schools, governmental entities or non-profits, specifically limited to such an individual customer serving only a single premises of that customer, pursuant to an SSA arrangement...."[2]

Several findings supported this conclusion, including the need for utilities to meet their Renewable Energy Standards and that the SSA model helped government and non-profit entities indirectly take advantage of tax-related financing.[3] Another finding that is particularly germane to this inquiry concerned other agencies, aside from the Commission, that the Commission identified as being available to protect consumers: the Registrar of Contractors overseeing construction practices; the Attorney General addressing consumer fraud concerns; and the courts providing civil remedies to SolarCity customers.[4]

This was the Commission's perspective in 2010. Since then, the amount of change and development in the rooftop solar industry has been extraordinary. Nearly every aspect of the industry has changed, from how the product is financed to how it is sold to who it is sold to. In the fast-paced expansion of a young industry like rooftop solar, 2010 was a lifetime ago.

II. In Light of Changes to the Rooftop Solar Industry, the Best Initial Step is to Collect More Information.

The rooftop solar industry's bursting expansion raises the same question implied by your letter: should the Commission's perspective from 2010 change? It might be that despite the immense changes, the Commission should continue to play no direct role and instead let other state agencies protect consumers, if necessary. On the other hand, it might be that the nature of the rooftop solar industry, or the complexity of the subject matter, calls for the Commission's unique expertise and constitutional authority. At this point, too many unknowns exist for a clear answer to emerge.

The number and significance of these unknowns prompts APS to suggest that at this stage of the Commission's inquiry, the best way to proceed is to gather information. And because the largest and most significant number of unknowns relates to information entirely in their control, this initial wave of information should likely come from the rooftop solar industry itself. Although interested stakeholders can provide other valuable information, they cannot offer the types of information presented by the rooftop solar industry in 2010, nor supply the additional information described below. To gather this information, the Commission could issue data requests, initiate workshops, and even hold hearings as appropriate. Other parties can provide their analysis of the data to assist the Commission in making its decisions as needed.

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[2] Decision No. 71795 at 70.
[3] *Id.* at 66.
[4] *Id.* at 65.

As noted in your letter, much of the conversation concerning rooftop solar has been driven by argument and anecdotal evidence. Some claim that other state agencies, like the Attorney General's office, can adequately protect consumers and that the number of consumer complaints about rooftop solar is low. Others assert that the numbers are low because the average consumer does not have enough information or the ability to assess the utility-rate projections in solar leasing contracts. These customers, the assertion continues, might not realize the true economics of a rooftop solar agreement until many years after signing the agreement. It is time to move beyond anecdote and argument. More information is needed.

III. Third Party Materials Already Identify Where the Commission Can Focus its Fact-Finding Efforts.

The Commission is one of several agencies and groups involved in this discussion. Many others have begun the process of highlighting where questions might exist. Indeed, Arizona's own Residential Utility Consumer Office has published a Consumer Guide for Rooftop Solar that is available on its website and is attached to these comments.[5] Similar guides and checklists have been published across the United States by a variety of entities, including the Colorado Public Utilities Commission,[6] the United States Department of Energy,[7] Colorado State University,[8] Rocky Mountain Power,[9] MidAmerican Energy Company,[10] the National Renewable Energy Laboratory,[11] and the Louisiana State University AgCenter.[12] APS is also preparing, and will subsequently issue, its own consumer guide. Taken together, these resources highlight several subject matters into which the Commission could inquire. The list below identifies certain key areas that repeatedly appear in these third-party resources, but it is by no means an exhaustive list.

1) Promised savings from installing rooftop solar

The Commission might benefit from assessing whether and how consumers are informed about the utility-rate projections. As discussed in the Energy Daily article attached as Exhibit 9, rooftop solar companies can use projected utility-rate increases to demonstrate savings to customers. The example in the article is a projection that utility rates will increase by 4.8% per

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[5] *See* RUCO's Consumer Guide to Rooftop Solar Photovoltaic (PV), available at https://ruco.az.gov/rucos-consumer-guide-rooftop-solar and attached as Exhibit 1.

[6] *See* publication entitled "Making the Decision to Go Solar" available at http://cdn.colorado.gov/cs/Satellite/DORA-PUC/CBON/DORA/1251631899591 and attached as Exhibit 2.

[7] *See* http://energy.gov/eere/wipo/downloads/homeowners-guide-financing-grid-connected-solar-electric-system-brochure-solar and attached as Exhibit 3.

[8] *See* http://www.ext.colostate.edu/pubs/consumer/10633.html and attached as Exhibit 4.

[9] *See* https://www.rockymountainpower.net/env/nmcg/cg/re.html and attached as Exhibit 5.

[10] *See* http://www.midamericanenergy.com/include/pdf/rooftop_solar_checklist.pdf and attached as Exhibit 6.

[11] *See* http://www.nrel.gov/docs/fy14osti/60972.pdf and attached as Exhibit 7.

[12] *See* www.lsuagcenter.com/solarpub and attached as Exhibit 8.

year.[13] And a recent settlement announced by Arizona's Attorney General involved a solar leasing company that "warned" customers of utility rate increases between 8-14% each year.[14]

The reality is much different. Data from the United States Energy Information Administration show that between 1993 and 2013, average utility rates only increased by 1.9% each year. Moreover, comparing simple increases on energy charges does not begin to address the complications associated with potential changes to rate design. Projected savings based on complex utility-rate projections can be difficult to understand in the easiest of circumstances, and the consequences are sometimes only apparent several years after the lease begins, if ever. Gathering information on this topic would aid the Commission's inquiry, and the subject of utility-rate projections might be a topic on which the Commission could lend its expertise.

2) The relative uniqueness of the solar leasing model

Consumers often enter into leases for significant items. For example, it is common to sign one-year home leases or three-year car leases. Rooftop solar leases, however, typically last twenty years. This is a timeframe beyond the typical leasing consumer's experience. Although a business might have the resources to accurately establish a net present value of a twenty-year lease obligation, the typical residential customer might not.

Aside from a consumer's decision-making process, ownership of a rooftop solar lease can be transferred to different companies during the twenty years. These changes in ownership can implicate responsibility for maintenance of the panels, and consumers' understanding of that responsibility. Changes in ownership might also become important if, for instance, the solvency of the company or companies involved is threatened. It is not that these events are occurring with frequency. The concern is that they could, and it is unknown whether the average consumer understands the implications of a twenty-year lease, or what to do if the company that owns the panels on their roof goes bankrupt. Just as RUCO, NREL, the DOE, the Colorado PUC, and others have raised the uniqueness of the solar leasing model, the Commission might benefit from exploring the nature and adequacy of consumer disclosures on this topic.

3) Impact on home sales

Twenty-year solar leases can sometimes complicate the subsequent sale of a home. For instance, if the buyer does not have a high enough credit score to assume the lease, the sale cannot proceed unless (i) the seller takes the solar panels with them to their new home (which might not be an option if the new home is an apartment or out-of-state); or (ii) buys out the lease (which can involve a significant payment and might render the home sale prohibitively uneconomic). The

[13] *See* "Solar rooftop installer assumes soaring utility rates in cost-saving claims," Energy Daily (February 9, 2015).

[14] *See* Press Release entitled "Attorney General Brnovich Settles Lawsuit Against Solar Company," available at https://www.azag.gov/press-release/attorney-general-brnovich-settles-lawsuit-against-solar-company.

Commission might benefit from understanding consumer disclosures regarding the real estate-related consequences of entering into long-term rooftop solar leases.

4) Reliability and continued dependence on the electric grid

Solar customers can be led to believe that by installing rooftop solar, they essentially disconnect from the grid. This can lead to further misunderstandings, including that the customer will no longer contribute to the grid's costs. The reality is that customers depend on the grid as much as ever when they install solar, if not more. That customers need the grid at night is readily apparent. But they also need the grid to start their air conditioning and other large appliances, and to export excess energy produced by their rooftop solar array onto the grid. Even SolarCity's CEO Lyndon Rive has acknowledged this truth. During the Commission's 2010 investigation into the rooftop solar industry, Mr. Rive testified that after installing rooftop solar, "the customer must remain connected to the utility grid for the majority of their electricity needs."[15]

It is important for customers to understand the benefits of rooftop solar, while at the same time perceiving the ongoing role of the grid. This is particularly true because customers' use of the grid can implicate rates. When customers mistakenly believe that they have "disconnected from the grid," it is natural for them to begin inquiring about their continued utility bills. With this investigation, the Commission can explore consumer disclosures regarding rooftop panels and continued grid use.

5) Additional topics

APS has had its own experiences related to customers encountering difficulties after installing rooftop solar. The document attached as Exhibit 10 is a sample of typical complaints (without identifying information) that APS has received from actual customers. The document is a summary of the complaints only in the form of the customer service notation. APS hopes that the Commission can use this document to identify topics of concern that customers with rooftop solar raise when they call APS.

In addition, existing consumer protection laws govern consumer rooftop solar transactions and may inform the Commission's inquiry. These laws include Federal Trade Commission regulations found in Section 5 of the FTC Act[16] and Regulation M,[17] as well as A.R.S. § 44-1522 in Arizona. Stated generally, these laws prohibit material misrepresentations in consumer contracts and require meaningful disclosures in consumer leases. The Commission should, at a minimum, explore whether current practices comply with these requirements. Given the complicated nature of utility-rate projections, among other items, it is doubtful that typical consumers would have

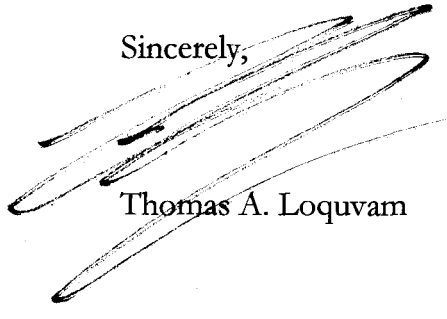
[15] In the Matter of the Application of SolarCity Corporation, Docket No. E-20690A-09-0346, testimony filed on August 24, 2009.
[16] *See* 15 U.S.C. § 45.
[17] *See* 12 C.F.R. Part 1013.

sufficient knowledge or information to take advantage of these laws. Nonetheless, examining how current business practices interact with these consumer-protection principles, and inquiring into the number and type of complaints invoking these laws, might inform the Commission's investigation in this docket.

IV. Conclusion

APS believes that the best guiding principle for this docket is the public interest. There are many possible outcomes that could meet the public interest, including keeping the status quo, enacting new Commission rules, drafting new legislation, securing self-regulation of the rooftop solar industry through enforceable stipulations, or establishing new targeted regulations. Undoubtedly, the public interest also includes a healthy and sustainable environment for solar development. To ultimately determine what is in the public interest, APS believes that the best initial step is to obtain more information. APS hopes that these comments provide insight into what categories of information might aid the Commission in its inquiry, and looks forward to assisting the Commission in any way that is needed.

Sincerely,



Thomas A. Loquvam

TAL/dk
Enclosures

c: Docket Control
Commissioner Bob Stump
Commissioner Bob Burns
Commissioner Doug Little
Commissioner Tom Forese
Parties of Record

COPY of the foregoing mailed/delivered this
13th day of February 2015 to:

Lyn Farmer
Administrative Law Judge
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Utilities Division
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Exhibit 1

Residential Utility Consumer Office's Consumer Guide

RUCO's Consumer Guide to Rooftop Solar Photovoltaic (PV)

Going solar can be a great investment, but there are many factors to consider before making a decision. This guide is meant to help anyone thinking about going solar make more informed choices.

1. Important Factors to Consider

With rooftop solar, many different factors impact the investment.

Known Factors:	Unknown Factors:
Ownership structure: A system can be owned or leased, and if leased there are various types (prepaid, zero down, etc.) There are also loans.	Energy efficiency potential of the home (if no home energy audit is conducted prior to solar installation)
Solar panel maintenance including eventual inverter replacement	Lifestyle, years staying in the home, and future energy use
Number, location, and approximate output of solar panels	Future changes to electricity rates and regulations*

*Solar companies often calculate your savings assuming utility rates will increase by a certain percent per year. Over the past 25 years residential utility rates have increased 1.0% per year in Arizona, however, if you look at the last decade, the rate of increase has been over 3.0% annually and 2.5% over the last 15 years. Like many investments, history is not necessarily an indicator of future rate performance and ultimately you must feel comfortable with any assumptions you are using while knowing they cannot be guaranteed by anyone including the utility or your solar installer.

Please also keep in mind that rate increases might be on bill charges that solar PV does not reduce (e.g. fixed monthly charges). Finally, each utility has different policies regarding their pricing for solar customers- check with your electric service provider so you understand their specific rates and charges.

General Considerations

- Be a smart shopper – obtain multiple quotes and bids.
- Future changes to electricity rates and regulations can impact the benefits outlined or estimated in your contract based on current rates.
    - There is no guarantee of being 'grandfathered'
- Some providers offer a guaranteed minimum level of system production.
    - It is recommended to ask for data monitoring on your system.

Lease Related Considerations

- Some leases contain a price escalator that increases the lease payments on an annual basis. Though a low annual escalator can make sense, they also increase the risk that lease payments may be higher than a pre-solar utility bill for some period of your contract term. Make sure you understand the rate of increase in your contract and how that relates to your expected savings.
- If you own a home with leased rooftop solar panels, you may be responsible for additional property taxes incurred by the leasing company.
- Unlike a direct ownership model, the leasing company, not the homeowner, is eligible to use the federal and state tax credits. However, the tax credits are typically factored into your lease payment.

2. "Going Solar" ≠ "Off the Grid"

Even with rooftop solar panels, customers still rely on the grid 24/7. It is unlikely that at any given moment, the electricity needs of your home and the production of the PV system will be the same. The connection to the grid enables a smooth exchange of power and energy as load and production vary. For example, when your air conditioner turns on, an immediate surge of power is needed. At night and on cloudy days with limited or intermittent sunlight, solar panels are not able to produce the energy needed to run your home. Therefore, unless the solar PV system is coupled with an energy storage solution, you still need a reliable energy source to ensure comfort and safety. This need is especially true given that most solar PV systems are designed to shut down for safety reasons if grid power is lost.

3. Make Sure the Roof is Solar-ready

Before moving forward with solar, know that a typical roof's average life expectancy is 20 years. If you do not know when your roof was installed or last repaired, having a professional inspect your roof prior to installing a solar system is a good idea. You could also incur costs relating to removing and reinstalling the PV system to conduct roof work.

The orientation of your roof will impact energy production potential, but, contrary to popular belief, a roof does not need to face directly south for solar panels to work. However, if an installer proposes north facing panels, it is recommended that you request an alternative bid without those panels for comparison purposes.

4. Picking the Right Installer

Working with a certified solar installer is your best bet. Fortunately, Arizona is home to some of the most reputable companies in the business. For leased systems, the company that leases the system may not be the company that installs it. It is also important to verify that the system warranty maintains intact if the installer goes out of business or if the leasing company sells the lease to another financing company.

Things to Consider

- Be careful of large down payments before work is performed.
- Get multiple bids and read and understand the contracts beforehand. The price of systems and the terms can vary greatly among installers and leasing companies.
- The Arizona Attorney General advises consumers to be cautious of companies that solicit by phone and/or use high-pressure sales tactics.
- Inform the HOA of your rooftop solar plans. A summary of HOA rules can be found here.
- If you plan to own the system, make sure you have enough tax liability to fully realize the 30% federal tax credit and other tax incentives that may be offered.
- Obtain a city permit prior to construction (this is usually done by the installer).
- Include liability guarantees in your contract to cover roof damage that may happen during construction.
- Be sure to work with both a reputable leasing company and installer.
    - Look for PV installers who are certified or have employees certified by the North American Board of Certified Energy Practitioners (NABCEP).
    - The Arizona Solar Energy Industries Association also maintains a list of solar panel installers that have obtained a Preferred Solar Installer credential.
    - Before selecting an installer, a good place to start is with referrals from friends, neighbors or associates (but make sure you know if they are being paid for the referral), then online reviews like Angie's list, ROC complaints, finally the Better Business Bureau (BBB).

5. Selling Your Home

It is possible that you may sell your home before completing the term of the 20-year solar system lease. Rooftop solar systems can be considered an asset and can increase the value of your home. Note that depending on the type of lease and the terms of your particular leasing company, payments may be considered a liability and an encumbrance may be placed on your property and/or the equipment. Depending on your lease agreement, options for selling the house may include:

- Buying out the remainder of the lease;
- Leaving the panels behind, in which case the home buyer must qualify and agree to taking over the lease;
- Moving the panels with you, if allowed under the lease terms.

6. Get Advice

With any significant investment, it's prudent to confer with experts. Consult a tax professional, your insurance carrier, and an Eco-Broker certified real estate agent. Consulting with the local fire department regarding their ability to access the house in the event of a fire is also advisable.

7. Become More Energy Efficient

Whether or not you go solar, it's always a good idea to improve your home's energy efficiency. Utilities offer a number of energy efficiency options to save you money and to improve the safety and quality of your home environment.

Making your home as energy efficient as possible will also help ensure that your rooftop solar system is properly sized for your current and future energy use. For instance, oversized systems cost more, and any excess electricity, you produce, is paid at a low wholesale rate towards the end of the year.

Visit the following utility webpages to learn more about available energy efficiency programs and to find energy saving tips:

- Arizona Public Service customers: http://www.aps.com/en/residential/savemoneyandenergy/
- Tucson Electric Power customers: http://www.tep.com/efficiency/
- Salt River Project customers: http://www.savewithsrp.com

Once the above considerations are followed, solar PV can be a great investment that allows you to be more than just a consumer of energy - but also a producer of clean energy.

Exhibit 2

Colorado Public Utilities Commission

Making the Decision to Go Solar

COLORADO
Department of Regulatory Agencies
Public Utilities Commission

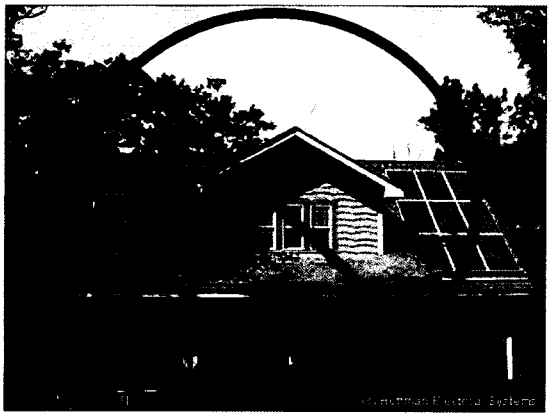
For Your Information — *EG-6*

MAKING THE DECISION TO GO SOLAR

If you are thinking about installing a solar photovoltaic (PV) system on your home, there are a number of important factors to consider and many online resources that are worth consulting. This brief guide will answer some basic questions and provide links to additional sources of information. ***Please note: the Public Utilities Commission (PUC) does not regulate companies that sell, lease and/or install PV systems.***

WOULD SOLAR PANELS BE EFFECTIVE ON MY HOME?

Solar panels need access to the sun. If there is foliage shading your roof, solar panels may not receive enough energy to be effective. In addition, you need a roof with a southern orientation that is large enough to support multiple solar panels. A reputable solar provider will assess the suitability of your home to support an appropriately-sized and oriented PV system, so be sure to ask for the details of this analysis. For a more complete discussion, see these guidelines from the Department of Energy: http://energy.gov/energysaver/articles/planning-home-solar-electric-system. This DOE publication may also be helpful: http://www1.eere.energy.gov/solar/pdfs/43844.pdf

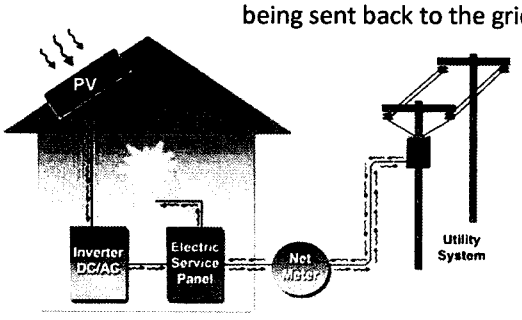


http://www.greenbeltsolar.com/solar_shading_article.htm

WILL INSTALLING A PV SYSTEM MAKE ME "ENERGY INDEPENDENT?"

Probably not. Some people find solar energy attractive because they believe they will be "off the grid." However, this would require a battery backup system to store excess electricity generated by the PV system and provide it whenever the sun is not shining. An off grid-system would not qualify for utility incentives and, at current battery costs, would be significantly more expensive than a grid-connected system. For now, off-grid systems in Colorado are only economically justified for remote locations that do not have existing utility service. This guide addresses grid-connected PV systems.

The Net Meter tracks the electricity coming from and being sent back to the grid



http://www.everblue.edu/blog/net-metering-legislative-crossroads

By law, most utilities in Colorado must offer net-metering for small on-site PV systems. As currently implemented, Net Metering (NM), also known as Net Energy Metering (NEM), is an electricity tariff billing mechanism that enables a utility customer to generate electricity on site to offset the customer's load and deliver any excess electricity to the utility in exchange for an equal amount of electricity from the utility at other times. See this Xcel Energy publication for more details: https://www.xcelenergy.com/staticfiles/xe/Marketing/CO-SR-net-metering.pdf

WHICH IS BETTER – PURCHASING THE PV SYSTEM OR USING A THIRD-PARTY PROVIDER?

This depends on your specific circumstances. The third-party provider model means that you do not own the PV system. Instead you make payments to a third-party owner through a lease or power-purchase agreement (PPA). If you can afford to purchase a system either outright or by obtaining financing, you should compare the economics of all of your options.

While the total cost of PV systems has been declining every year, the net cost to you depends on several factors, including the availability and level of utility incentives and federal and state/local tax credits, and the terms of your purchase, lease or PPA. Whether you are interested in buying the PV system, prefer the third-party model or have not determined which makes more sense, you will want to get quotes from more than one provider. Three is generally recommended. Be sure to research your options and the potential providers[1] and consider talking to a financial professional about this investment.

Colorado State University Extension has published a consumer guide with tips for considering PV leasing: http://www.ext.colostate.edu/pubs/consumer/10633.html. Also consult this DOE guide comparing owning to leasing/PPAs: http://www1.eere.energy.gov/solar/pdfs/48969.pdf

Solar Lease/PPA versus Customer Ownership

FINANCING OPTION	UPFRONT COST	MONTHLY COST	20-YEAR BENEFIT	SYSTEM OWNED BY
$0-down Lease / PPA	—	$$$	$	Solar Co.
Prepaid Lease / PPA	$$$	—	$$$	Solar Co.
Custom Lease / PPA	$	$	$$	Solar Co.
Purchase	$$$$	—	$$$$	You
Purchase with loan	—	$$	$$	You

http://www.energysage.com/solar/financing/comparing-solar-loans-vs-solar-leases

HOW DO I EVALUATE THE COST/SAVINGS ANALYSIS AND COMPARE MY OPTIONS?

Once you have quotes from one or more PV companies, you will need to evaluate how the costs compare to the savings over time. If such an analysis is presented by the provider, make sure that you understand the assumptions that went into the calculations and pay particular attention to the following factors:

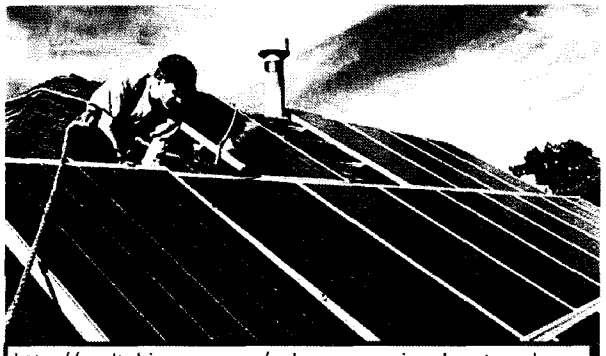
- What is the assumed annual increase in the rate you pay your utility for electricity? If this value is higher than the increase that actually occurs, your savings will be lower than portrayed by this analysis.
- When do the advertised savings occur? Savings are less certain if they are realized towards the end of the contract (since future utility rates are unknown) and are worth less today (due to the time value of money).
- If you are evaluating purchasing the system:
  - Does the analysis include the cost of replacing the inverter?[2]
  - If you are financing the PV system, does the analysis accurately portray the loan payments and any tax credits (e.g., for a home equity loan)?
  - Will you recoup the investment tax credit as portrayed?
  - What are the warranty terms? Does the warranty apply for the entire period that is evaluated?
  - Will there be implications for homeowner's insurance? You should ask your homeowner's insurance provider how installing rooftop PV will affect your policy.

[1] Ask for references and see, for example, http://www.bbb.org/ or http://www.solarreviews.com/

[2] Inverters are the devices that convert the direct current (DC) produced by the PV panels to the alternating current (AC) used in your house. Inverters generally have a lifespan of less than 20 years. Use the warranty term for a conservative estimate.

- If you are evaluating paying a third-party owner:
  - Are all maintenance and equipment replacement costs included in the estimate? For example, the inverter(s) will need to be replaced.
  - Are the monthly or per kWh payments fixed or do they increase each year? If they increase, what is the escalation rate?
  - What guarantees are included in the contract? If a lease arrangement is offered, is the monthly PV production guaranteed? What happens if production is lower than promised? Are the terms of the contract guaranteed for the entire period?

Be aware that the price you pay for electricity service could change over time in a way that impacts the savings analysis. For example, most residential customers now pay a small fixed monthly charge for "Service and Facilities" (currently $6.75 for Xcel customers) and the remainder of their monthly bill depends on the amount of electricity used (i.e., the number of kilowatt hours (kWh)). A PV system offsets the kWh through "net-metering," potentially leaving zero net usage charges. However, if the rate structure for residential customers changes, customers may be asked to pay a larger fixed amount each month. That would reduce the estimated cost savings for installing a PV system.



http://realtybiznews.com/solar-companies-donate-solar-arrays-to-dallas-habitat-for-humanity-homes/9876577/

A detailed look at these and other considerations was provided by a solar financial analyst in this 2009 paper: http://www.ongrid.net/papers/PaybackOnSolarSERG.pdf

You can also do your own calculations to determine how the costs and savings are likely to work out. See, for example: http://www.find-solar.org/index.php

ARE THERE OTHER ISSUES I SHOULD CONSIDER?

- The amount of electricity you use determines the appropriate size for your PV system. If you can reduce your electricity use through energy efficiency measures (e.g., replacing incandescent with CFL or LED light bulbs), you will need a smaller PV system.
- To qualify for net-metering, on-site PV systems cannot produce more than 120% of the customer's average annual electricity consumption. You should confirm that your provider is not proposing a system that would exceed this level of production. Also, if you are an Xcel Energy customer and elect to be paid for any excess generation at the end of the year (rather than continuously rolling over the excess), you will only earn the average hourly incremental cost of electricity. In recent years this value on Xcel Energy's system has ranged from 1.7 to 2.9 cents per kilowatt hour (kWh). Check with your electricity provider to determine its specific policy for net-metering.
- Make sure you know the implications for either an owned or third-party system if you decide to sell your home or need to replace your roof.
- By committing to a long-term investment or contract, be aware that you may be unable to take advantage of technological innovations in solar.
- If you purchase the system and receive incentives from your utility, you may need to determine whether those payments are taxable as income.
- Currently, PV systems that are located on and producing power for residential property are exempt from personal property tax in Colorado. (Must be less than 2 MW for customer-owned systems and less than 100 kW for third-party systems.) You should confirm that this is still the case.

ARE THERE OTHER OPTIONS TO OBTAIN SOLAR ENERGY?

If your house is not suitable for a PV system or you do not own a house, you may be able to invest in a Community Solar Garden. Information about Xcel Energy's program is available here: http://www.xcelenergy.com/Save_Money_&_Energy/Residential/Renewable_Energy_Programs/Solar*Rewards_Community_-_CO

If you are not an Xcel customer, contact your electricity provider to determine whether there are any Solar Gardens to which you could subscribe.[3]

WHERE CAN I LEARN MORE ABOUT ROOFTOP SOLAR PV?

If you are a customer of Xcel Energy or Black Hills Energy, check their websites for information about the incentives they offer and the required process for installing a grid-connected PV system.

Xcel Energy: http://www.xcelenergy.com/Save_Money_&_Energy/Residential/Renewable_Energy_Programs/Solar*Rewards_-_CO

And see in particular Xcel's "Frequently Asked Questions" (FAQ) publication. Many of the questions are relevant to anyone considering a grid-connected PV system, even if you are not an Xcel customer: http://www.xcelenergy.com/staticfiles/xe/Marketing/Managed%20Documents/co-res-bus-Solar-FAQs.pdf

Black Hills Energy: http://www.blackhillsenergy.com/solar

If your electricity provider is a cooperative electric association or a municipal agency, check their website or call them for more information.[2] You can also find information about all Colorado incentive programs and policies related to solar PV at the Database of State Incentives for Renewables & Efficiency (DSIRE) website: http://www.dsireusa.org/solar/incentives/index.cfm?re=1&ee=1&spv=1&st=0&srp=0&state=CO

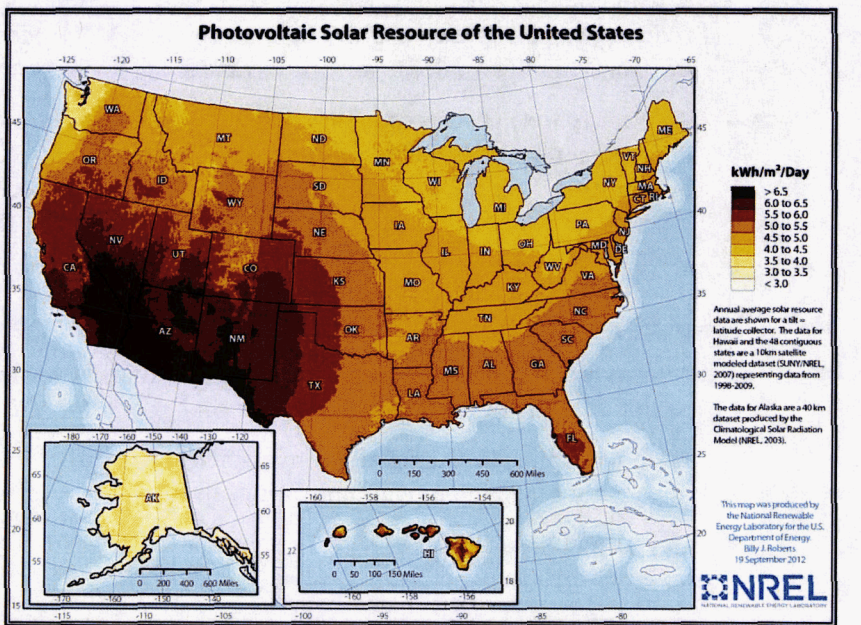
Additional Resources are available from the National Renewable Energy Laboratory (NREL) website. http://www.nrel.gov/learning/re_solar.html

For example, NREL's PVWatts tool lets you calculate expected monthly electricity production based on a PV system's size, orientation and tilt. See http://pvwatts.nrel.gov/

NREL and other DOE Offices also provide information about other renewable energy and energy efficiency options that you may want to research as alternatives to or in conjunction with rooftop PV.

http://energy.gov/public-services/homes/saving-electricity

http://www.nrel.gov/learning/homeowners.html



http://www.nrel.gov/gis/images/eere_pv/national_photovoltaic_2012-01.jpg

[3] A map of and links to Colorado Electric Cooperatives are available here: http://www.coloradorea.org/ColoradoCoops/CoopMapofColorado.aspx. A map of and links to Colorado Municipal Utilities are available here: http://coloradopublicpower.org/

Exhibit 3

U.S. Department of Energy's

Homeowners Guide

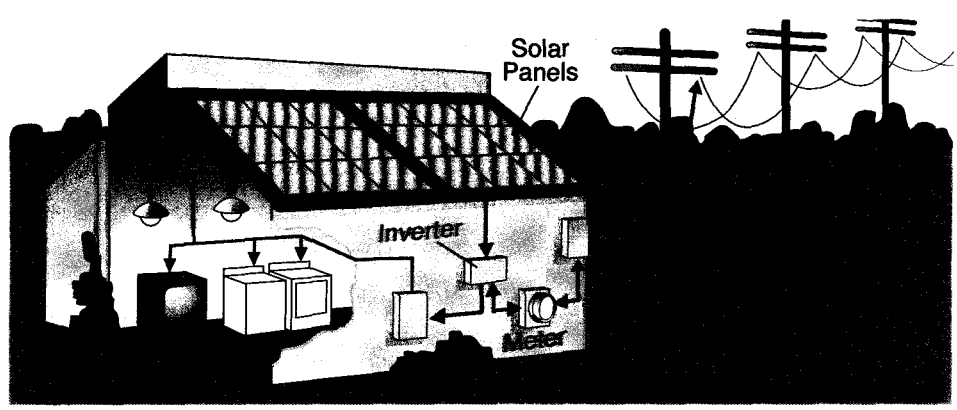
Credit: Altair Energy, PIX 07900

Homeowners Guide to Financing a Grid-Connected Solar Electric System

This guide provides an overview of the financing options that may be available to homeowners who are considering installing a solar electric system on their house.

How a PV System Works

Solar electric systems, also known as photovoltaic (PV) systems, convert sunlight into electricity. Because they are made up of individual modules, PV systems can be designed to meet most electrical requirements, both large and small. The size of a residential PV system is expressed in terms of kilowatts (kW) of power, and the electricity produced by a PV system is expressed in kilowatt hours (kWh) of energy. Systems are said to be "grid-connected" when they remain plugged into the local utility. Grid-connected PV systems may have a battery back-up system, but most do not. Battery back-up is typically used for off-grid systems and provides power at night when the sun is not shining. Grid-connected systems rely on their utility to provide power at night. The diagram on the right illustrates a basic PV system installation. Maintenance requirements for PV systems are minimal: they may require occasional cleaning for optimal performance,



and often require a new inverter after 10-15 years. The best way to ensure a PV system is working well is to install a monitoring device that tracks the electricity output of the system. Numerous online system monitoring tools are available, and some are included in the cost of the installation.

Benefits of a PV System

Installing a PV system on the roof or in the yard provides several benefits to a homeowner. Because you are producing your own electricity, your utility bills will be lower. PV systems can last for 30 years or longer, and therefore provide long-term protection against rising electricity rates your utility may charge as worldwide energy markets change. A PV system may also increase the value of your home. Finally, a PV system produces electricity without a emitting any pollution, including greenhouse gases.

Getting Ready to Install a PV System

If you are interested in "going solar," there are several important steps to take in preparation. If your goal is to reduce your environmental impact or the cost of the installation, consult

a professional prior to installing a solar PV system about home energy efficiency improvements such as sealing unwanted air leaks, improving insulation, and replacing inefficient lighting. This will reduce the amount of electricity your home uses so that you can meet a greater percentage of your electricity needs with your PV system or reduce the size of the system required. If you plan to install PV on your roof (as opposed to mounting it on the ground), have a solar installer or general contractor check to see if your roof needs to be reinforced or replaced, especially if it is an older roof. Get bids from multiple solar companies, and seek out solar installers that guarantee their work and, when possible, are certified by the North American Board of Certified Energy Practitioners (NABCEP). For a list of installers in your area, check the Web site of the Solar Energy Industries Association (*http://www.seia.org/cs/membership/member_directory*). If you learn that your property is not well suited for a PV system because of shade or other issues, check with your utility about options to invest in an offsite solar system through a green power purchase or "community solar" program. Finally, learn about solar technologies, financing options, and available PV incentives to ensure that you have the information you need to make the best decisions. By reading this guide, you are off to a good start.

What a PV System Costs

Although the cost of a residential PV installation has declined in recent years, it is still a significant investment for homeowners. Even after subtracting available incentives, an average-sized PV system of 4 kWh can cost $20,000 or more. As a result, most homeowners will need to finance this upfront investment. Fortunately, as the residential solar market has evolved, a number of financing options are now available in many areas across the country, in addition to the traditional use of a home equity loan.[1] Under some financing structures, the homeowner owns the PV system; under other financing structures a third party owns and operates the system on the homeowner's property. Homeowners should factor maintenance requirements into their financing decision. While all PV systems have minimal maintenance needs, customers who are not interested in checking system performance and arranging for inverter replacement, which can cost several thousand dollars, should consider third-party financing options or, if possible, set up a maintenance contract with their solar installer. This guide compares some common financing options: a cash purchase, a home equity loan, other loan products, a solar lease, a solar power purchase agreement (PPA), and property tax assessment financing.

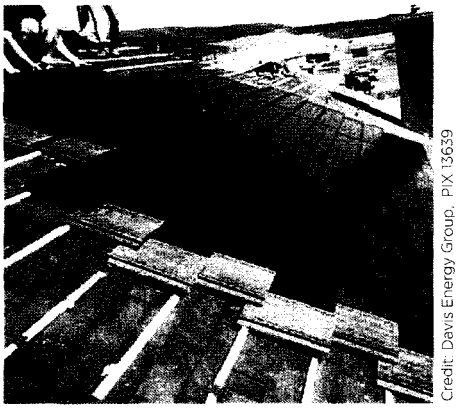
Key Terms

The following terms are some that you will likely hear during conversations with solar installers and administrators of solar incentive programs. Understanding these terms can help you make the best financing decisions.

Interconnection: This is the process of connecting the PV system to the electric grid of the local utility. The solar installer will likely coordinate this process, although the homeowner may need to provide documentation such as proof of sufficient homeowners' insurance.

Net Metering: This term refers to the ability of the homeowner's PV system to send excess electricity to the utility grid in return for a credit on utility bills. It is sometimes referred to as "spinning the electricity meter backward." Net metering regulations vary by state and utility, and where they are in place they make solar PV purchases more cost-effective for homeowners. To participate in net metering, your utility may require that an additional meter be installed at the home.

Production Output Guarantees: It is increasingly more common for solar companies to offer production guarantees to the homeowner. The terms of this guarantee will vary widely, but in general it will be an annual or two-year average guarantee of kWh produced. If the PV system fails to meet this minimum level of production, the solar company will compensate the homeowner on a per-kWh basis for the shortfall.



Credit: Davis Energy Group, PIX 13639

Rebates/Incentives: In some states, upfront rebates based on the size of the system or production incentives based on the amount of electricity generated are available to reduce the cost of owning a residential PV system. The rebates are usually expressed in dollar-per-watt terms and the production incentives on a per-kWh basis. These rebates and incentives can be paid by a state agency (such as the state energy office), the local utility, or a nonprofit organization acting on behalf of the state. (State-specific information is available at *http://dsireusa.org/*.)

Renewable Energy Certificates (RECs): A REC reflects the environmental attributes of producing clean electricity and is priced on a megawatt-hour (MWh) basis. Under some incentive and financing structures, the utility or solar company will automatically own the RECs associated with a PV system. In other cases, the homeowner will own the RECs and can receive compensation by selling the RECs to a REC aggregator.

Residential Investment Tax Credit (ITC): If a homeowner purchases a PV system, they can take a federal tax credit equivalent to 30% of the qualified installed costs of a residential PV system. If a homeowner has received other upfront cash incentives, they should be subtracted from the initial cost of the system before calculating the 30% ITC.

[1] Home equity loan is a general term for various types of loans that use a homeowner's property as collateral. Home equity loans can include standard home equity loans with fixed terms, a home equity line of credit, and mortgage refinancing.

Financing Options

Cash Purchase Option. As with any other purchase, buying a PV system outright with cash avoids the cost of financing, such as interest and fees. With a cash purchase of a PV system and no monthly payments of any kind to make, your ongoing savings will be the highest. Buyers should consider alternative investment opportunities and ensure that the long-term investment in a PV system is right for them.

Home Equity Loan. Borrowing against the value of your home is a common form of financing. Because such loans are secured (guaranteed by the value of the home), the interest rate can be favorable and the interest paid is often tax deductible.

Other Loan Products. Local banks and credit unions may be a source of unsecured loans (loans not backed by any collateral) or loans secured by the PV system itself, often in partnership with a solar company. The terms of such loans will likely be less favorable than the home equity loan. The interest paid on these loans is usually not considered tax deductible.

Solar Lease. As with a car, it is possible to lease a PV system rather than purchase one directly. In this case, the solar company and its financial partners own the PV system that they install on your property. As the owner, the solar leasing company takes all the tax credits, rebates, and incentives. Under certain solar lease programs, the leasing company is responsible for system maintenance and repair; under others, maintenance and repairs remain an obligation of the homeowner. At the end of the lease term, the homeowner can renew the lease, purchase the system, or have the system removed. The homeowner will make monthly lease payments to the solar leasing company, which will be offset by utility bill savings. Terms of the lease will vary by program.

Solar Power Purchase Agreement (PPA). A solar PPA is similar to a solar lease in that the solar company owns the PV system on the homeowner's roof. The difference is that instead of leasing the solar equipment, the homeowner agrees to purchase all of the electricity that the PV system generates over some fixed period of time (up to 20 years). As with a lease, the PPA provider takes all the tax credits, rebates, and incentives. Most PPA providers will guarantee a minimum amount of energy that the system will produce and compensate the homeowner if the system fails to produce this agreed-upon amount. Unless the homeowner opts to pay for all the electricity in a one-time payment (a prepaid PPA) they will receive two electricity bills—one from the utility and another from the PPA provider. The sum of these two bills may be less than the homeowner's original utility bill. As the owner, the solar PPA provider is responsible for system maintenance, repair, and insurance for the term of the contract. At the end of the agreement, the homeowner can renew the PPA, purchase the system, or have it removed.

Property Assessed Clean Energy (PACE). PACE[2] is a form of financing offered by some local governments that uses a property tax assessment mechanism. To see if PACE is available in your location, consult *http://dsireusa.org/*. In a PACE program, the city or county government provides the upfront capital to finance the cost of the PV installation. A lien is then attached to the homeowner's property, which the homeowner pays off over an extended period of time through special assessments on their property tax bill. If the home is sold, the PACE lien is typically transferred to the new owner. To qualify for PACE financing, a home energy audit may be required. Under a PACE program, the homeowner is responsible for system maintenance. Homeowners should check with their mortgage lender about the possible impacts of a PACE lien on their mortgage terms.

[2] As of September 2010, most residential PACE programs in the country were on hold given guidance from the Federal Housing Finance Agency (FHFA) related to the seniority of a PACE lien vis-à-vis existing mortgage loans. Refer to VoteSolar (*http://votesolar.org/*) for periodic updates on PACE.

Group Purchase Programs

Neighbors can organize to solicit bids from solar installers for PV installations on multiple homes. A group purchase program allows the members to share the upfront work needed to make a purchase decision and reduce the amount that each homeowner pays. A group purchase can use any of the different financing options.

Credit: Unger, Cheryl, PIX 15626

Glossary of Technical Terms

- **Azimuth**—Direct south-facing PV systems in the northern hemisphere have an azimuth of 180 degrees, the ideal azimuth for maximum energy production.
- **Efficiency**—Refers to the percent of sunlight converted into electricity by a solar cell or module.
- **Inverter**—Converts electricity from direct current (DC) to alternating current (AC).
- **Kilowatt (kW)**—Unit of power equivalent to 1000 watts. Sizes of PV systems are expressed in kW.
- **Kilowatt hours (kWh)**—Unit of energy consumption. Homeowners are billed on a kWh-basis.
- **Load profile**—The general pattern of electricity use by a house over a given period of time. Load profiles help determine the appropriate size of the PV system to install.
- **Module**— Solar cells are combined into a solar module, which is also called a solar panel.
- **North American Board of Certified Energy Practitioners (NABCEP) Certification**—A professional solar installer certification resulting from the completion of a rigorous examination process.
- **Tilt angle**—The angle at which a PV array is set facing the sun relative to a horizontal position.

Summary Table of Financing Options

The following table provides a side-by-side comparison of the options available to homeowners who wish to finance a solar installation. Note that not all options are available in every state or local jurisdiction, and terms will vary widely.

FINANCING OPTION:	Purchase with Cash	Home Equity Loan	Other Loans	Solar Lease	Residential PPA	PACE
	High	**Low**	**Low**	**Low**	**Low**	**Low**
Upfront Costs	Cash purchase includes the full cost of the PV system minus any upfront rebates.	There may be fees at the loan closing.	There may be fees at the loan closing.	Certain plans may also have a down payment option.	Certain plans may have a down payment or a prepayment of electricity option.	Likely to have an upfront fee; usually less than $100.
Who owns system?	Homeowner	Homeowner	Homeowner	Solar company	Solar company	Homeowner
Ongoing payments	None	Yes – monthly loan payments	Yes – monthly loan payments	Yes – monthly lease payments	Yes – monthly electricity payments	Yes – monthly escrow payments as part of mortgage*
Who maintains the PV system (or pays to maintain it)?	Homeowner (maintenance contracts usually available)	Homeowner (maintenance contracts usually available)	Homeowner (maintenance contracts usually available)	Usually the solar company but not always	Solar company	Homeowner
Can homeowner take the federal tax credit?	Yes	Yes	Yes	No	No	Yes
Tax deductibility	N/A	Interest on loan	No	N/A	N/A	Interest portion of the assessment
Term of financing	N/A	5-30 years	Up to 10 Years	Up to 20 years	Up to 20 years	10-20 years

*Homeowners without a mortgage will pay their special assessment at the same time as other property taxes are due (annually or bi-annually).

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

EERE Information Center
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www.eere.energy.gov/informationcenter

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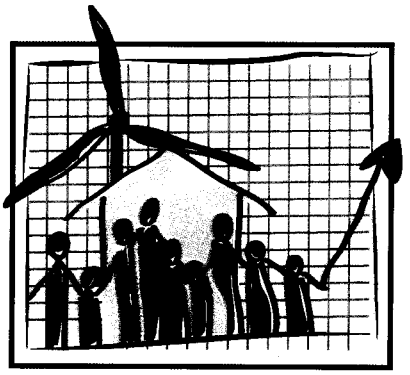
Exhibit 4

Colorado State University's

Solar Leasing for Colorado Homes

Colorado State University
Extension



Solar Leasing for Colorado Homes

Fact Sheet No. **10.633** Consumer Series | **Energy**

by C. Weiner*

A residential solar lease is a contractual agreement between a homeowner and a solar provider in which the homeowner leases solar photovoltaic (PV) panels from the provider for generating electricity. Under the terms of the lease, the homeowner is typically responsible for making monthly payments to the solar provider in exchange for the installation of and electricity generated by the panels and the insurance and necessary repairs of the PV system. The PV system is tied into the utility grid in order for the solar provider (and ultimately the homeowner) to take full advantage of financial incentives.

Lease or Own?

One of the most attractive features of a solar lease is that a homeowner can put as little as zero money down on the system. On the other hand, purchasing a system even with a bank loan usually requires at least some down payment. Some homeowners are adverse to or unable to get a bank loan for this purpose. In addition, a 10-year bank loan can result in relatively high monthly payments for a system that lasts 20 years or more. Purchasing a solar PV system with cash can require upwards of $10,000.

Another attractive feature of a solar lease is that the contract usually holds the solar provider responsible for performing any required maintenance on the system including replacing inverters and other parts. The solar provider has an incentive to make sure the system is operating well because they guarantee a minimum annual level of electricity generation and pay the homeowner a pre-determined price for every kilowatt-hour below that minimum should it not be reached. The solar provider also covers insurance for the system.

Table 2 at the end of this fact sheet provides a fuller list of considerations that will help you decide if leasing or owning is right for you.

Analyzing Lease Costs

Costs associated with a solar lease contract can be broken into four parts:

1. Initial payment—Solar providers usually will not require any minimum down payment. Monthly payments will decrease as initial down payments increase. Those looking to pay less than their current monthly electric bill starting in the first month of the lease contract may have to put at least some money down.
2. Monthly payment—The monthly payment is the amount you will pay the solar provider every month for the first year of the contract. If there is no annual rate increase, this is also the amount that will be paid to the solar provider for the remainder of the contract (usually 20 years).
3. Annual rate increase—Some contracts will include an annual rate increase to the homeowner's monthly payments. Leases that include annual rate increases often start with lower monthly payments in year one when compared to leases with no rate increase. Even small annual rate increases (i.e. 3%) can result in large cumulative increases in lease payments in the latter half of a contract. Locking in a fixed monthly payment over the life of a 20-year lease can give you a certain peace of mind even if initial monthly payments end up greater than what you're currently paying per month for utility-provided electricity. Note that average electricity prices in Colorado have risen 7.25% per year

Quick Facts

- Solar leasing has made solar photovoltaics (PV) more financially feasible for homeowners who are unable to or uninterested in getting a traditional bank loan.
- Under the terms of a solar lease, a homeowner is typically responsible for making monthly payments to a solar provider in exchange for the installation of and electricity generated by the panels and the insurance and necessary repairs of the PV system.
- Before signing a contract, make sure you feel comfortable with all the terms of the lease. Common, significant elements cover system performance, transfer and termination of the lease, purchase of the system, liability, environmental attributes, and amendments.
- The PV system is tied into the utility grid in order for the solar provider (and ultimately the homeowner) to take full advantage of financial incentives.

www.ext.colostate.edu

*C. Weiner, Colorado State University, clean energy Extension specialist. 8/2012

Figure 1. Residential Solar PV

from 2007 – 2011 according to data from the U.S. Energy Information Administration.

4. Upgrades as necessary—Some homes will need to have structural or electrical improvements before solar PV panels can be installed. For example, attic trusses may need to be reinforced in order to accommodate the weight of the panels on the roof. Such costs may be "rolled in" to the lease if the upgrades are performed by the solar provider. If not, a homeowner would have to pay for the necessary upgrades out-of-pocket.

It is important to note that if a system is mounted to the roof and the roof needs to be replaced during the life of the lease, having the solar provider remove and then replace the PV system for the roof replacement can cost $2,000 or more. For this reason it is best to install roof-mounted solar PV systems on newer roofs in good condition and/or to plan for this cost before entering into an agreement.

Understanding Common Lease Clauses

Before signing on the dotted line, make sure you feel comfortable with all the terms of the lease. Common, significant elements of most solar leases cover system performance, transfer and termination of the lease, purchase of the system, liability, environmental attributes, and amendments.

Considering performance, it is important to compare the level of production guaranteed by the solar provider in the lease proposal to an estimate from an independent third party. The National Renewable Energy Laboratory offers an online tool called PV Watts which can be used for this purpose. To use PV Watts, be prepared to know the approximate tilt (i.e. 30 degrees), azimuth (i.e. 180 degrees or true south), and size (i.e. 3.5 kW DC) of the proposed system. If your system would receive significant shading, this should be manually accounted for in PV Watts's 'derate factor'.

The guaranteed minimum electricity generated should be relatively close to the production estimated by PV Watts. Homeowners are typically responsible for trimming trees or preventing other obstructions from blocking the panels if they could affect the guaranteed minimum. Homeowners are typically responsible for the occasional cleaning of the panels to maximize electrical output.

Also note that solar PV systems generate more electricity at the beginning of their life than at the end. It is wise to assume a loss of production of about 0.5% per year when comparing the solar provider's production estimates to your own.

Considering the status of the lease should the homeowner sell the home, a few options exist. One option is to simply transfer the lease to the incoming homeowner assuming that homeowner meets the credit requirements of the solar provider. To be eligible for a solar lease, homeowners may need a credit score of 700 or higher. A common second option is to prepay all remaining lease payments and add the value of the system to the asking price of the home. Some solar providers may even let you move the system to your new home, assuming you pay all associated costs. Another option offered by some solar providers is for the new buyer to purchase the system.

Even if the house isn't for sale, many solar providers allow homeowners to purchase the system at the end of the lease (some will also allow for purchase of the system before the end of the lease term). The purchase prices will typically be fair market value as determined by a third party appraiser. Other options once the end of the lease term is reached include having the solar provider remove the system at no cost or extending the term of the lease.

Homeowners are generally not held liable for damage to or theft of the system unless there is gross negligence or harm is intentionally done to the system.

With respect to environmental attributes such as renewable energy certificates (RECs), the solar provider retains these rights. This means that homeowners who lease cannot later sell their RECs as some owners of solar PV systems have done. See this U.S. Environmental Protection Agency website for more information about RECs: www.epa.gov/greenpower/gpmarket/rec.htm.

It is also important to know whether the contract can be amended and if so in what way(s). There have been cases of solar providers amending the contract to raise rates, leaving the homeowners with no recourse and financial instability.

Other Things to Watch For

Aside from reading the fine print of a lease proposal, it is important for homeowners to feel comfortable making the long-term commitment associated with a solar lease. Questions to ask of your prospective solar provider include:

- Will the solar provider make a site visit before the lease is finalized? Some solar providers offer a turnkey service that doesn't always include site visits prior to the final agreement and that can result in unexpected costs to the homeowner once a site visit is made.
- How do I know if my electrical system can accommodate the panels without an upgrade?
- How do I know if my roof is capable of supporting the panels?
- How long has the provider been in business and how many leases have been sold? Has the provider been active in Colorado? For how long?
- What happens to my lease should the provider go out of business?
- Who will be installing and repairing my system—is it a local solar company or other sub-contractor? Are they certified by the North American Board of Certified Energy Practitioners (NABCEP)?

Sample Scenario

To give you a better idea of the costs and benefits associated with solar leasing vs. purchasing, a sample scenario in which homeowners are considering a typical residential 5kW solar PV system is outlined in Table 1.

In this example, the financial benefits of the solar lease option greatly exceed those of the purchase option over a 20 year period. It should be noted, however, that utility and state rebates were not factored into the purchase option and that these

may be available at the time of purchase. In addition, this simple example does not account for any value added to the home from the purchase of a system, the future value of money (due to inflation), and the possibility that the owned system lifetime could exceed 20 years. Should a homeowner own a solar PV system for 25 years, for instance, an additional $10,795 in savings would accrue using the set of assumptions in the example. Conversely, the purchase of a new inverter (often requiring replacement after 10 years) was not factored into the solar purchase scenario.

It is also important to note that the figures used in this example were based off of recent quotations and discussions with those in the solar industry. Xcel Energy, Colorado's largest electric utility, currently has a financial incentive system for solar leases that gets less attractive as more people sign up for leases. The highly volatile world of financial incentives can change the lease vs. purchase equation almost overnight.

Colorado State University Extension's solar lease calculator can be used to assist homeowners considering a solar lease, while our solar PV feasibility calculator can be helpful in conducting an economic analysis for ownership of a system.

Conclusion

Solar leasing has made solar PV more financially feasible for homeowners who are unable to or uninterested in getting a traditional bank loan. Depending on the lease proposal, homeowners in Colorado can start saving money as early as the first month of the lease, whereas most of the savings from the purchase of a solar PV system are reaped after the loan is paid off. Conveniences of leasing, such as solar provider-insurance and repair, need to be weighed against potential complications. These could include what might happen during the sale of the home and the uncertain ability of relatively new solar providers to stay in business throughout the course of the lease term.

Before entering into a solar lease, it is important to understand the specific terms offered by the solar provider and to conduct a sound, up-to-date financial analysis of one's options for solar energy. Table 2 summarizes the differences between owning and leasing for homeowners who would like to use solar PV.

Table 1. 20 Year Financial Comparison of Leasing vs. Owning a 5kW Solar PV System

VARIABLE	PURCHASE	LEASE
Total installed cost	$25,000	-
Cost net federal tax credits	$17,500	-
Down payment	$5,000	$500
Loan amount	$12,500	-
Financing term	10 years	20 years
Interest rate	5%	-
Monthly payment	$133	$65
Annual rate increase	-	-
Total payments	$20,910	$15,600
20 year savings*	$21,903	$21,903
Net 20 year savings	$993	$6,303
First year of savings	Year 11	Year 4
Payback period	20 years	9 years
*Assumes 7,000 kWh offset and an electric rate of $0.10/kWh in Year 1, a 0.5% annual electricity production decrease, and a 5% annual rate increase		

Table 2. Factors to Consider for Leasing vs. Owning Solar PV

Leasing Solar PV Might Be Right For You If...	Owning Solar PV Might Be Right For You If...
You have little or no money to put down	You can pay for a system in cash or you don't mind taking out a loan
You don't want to take out or don't qualify for a loan	
Your income tax liability is not large enough for you to take advantage of federal tax credits over a reasonable time frame	Your income tax liability is large enough for you to take advantage of federal tax credits over a reasonable time frame
The economics of a lease are better than the economics of purchasing	The economics of purchasing are better than the economics of a lease
You don't want to spend time on system maintenance (even though it's limited)	You don't mind performing or arranging for limited system maintenance
You feel confident in a leasing company's ability to provide services over the full course of the lease	You'd rather not rely on a leasing company for services related to your system
You are willing to risk having to purchase the system at fair market value if you decide to sell your home and cannot transfer the lease to your buyer	You don't want to risk a potential complication over the sale of your home due to a solar lease

Exhibit 5

Rocky Mountain Power's

Thinking About Rooftop Solar Checklist

Thinking about rooftop solar?

Things to consider when evaluating a potential rooftop solar project for your home or other property.

ROCKY MOUNTAIN POWER

Let's turn the answers on.

Permitting and other approval considerations	Notes
What building/zoning permits and other permits and approvals, if any, will be necessary for the project and who will be responsible for paying for and obtaining each?	
Does my homeowner's association or any other entity have rules or restrictions with respect to installing rooftop solar or are there real estate covenants affecting my property that apply to rooftop solar installations? Who is responsible for ensuring that all necessary approvals are obtained and these rules, restrictions and covenants are complied with?	
Who is responsible for making sure the installation meets any applicable fire department policies or other local fire code requirements or any wind loading requirements?	
Who is responsible for satisfying applicable electric codes for any existing and new wiring?	
What are Rocky Mountain Power's tariff or other requirements that must be complied with in order to connect the rooftop solar system to Rocky Mountain Power's electric distribution network? Who will be responsible for requirements related to the initial construction and the continuing obligations that may be applicable during the period the rooftop solar system remains connected to the utility's network?	
Are there any federal, state or local environmental laws that apply to the particular solar panels (their use, removal or recycling) and to construction activities? Who will be responsible for the costs and the compliance requirements?	
If I have a mortgage on my home or if I am purchasing or leasing my home, what restrictions and requirements does my mortgage, purchase agreement or lease contain that may impact my ability to install a rooftop solar project?	

Installation and construction considerations	Notes
Is the installer certified by a local, state or national business rating organization and/or what is its rating? You should conduct a thorough due diligence review of the installer similar to the review you would conduct on home builders and home improvement contractors who perform significant work on your home and property.	
Are the panels and other key equipment certified by a reputable rating organization?	
Does my homeowner's insurance cover damages or injuries sustained during the construction and ongoing operation of the rooftop solar system? Are there other requirements (certifications or periodic inspections) or other insurance issues associated with having a rooftop solar system on my home?	
Who determines whether my home, including roof and electrical system, are structurally sufficient to safely accommodate the installation of the applicable rooftop solar facilities?	
Will the panels create any reflection or glare that may impact my neighbors?	

Installation and construction considerations (cont.)	Notes
What safety standards must be followed during installation, operation and removal of the rooftop solar system and who provides oversight? What steps will the installer take with respect to fall protection, personal protective equipment, working with and mitigating electrical hazards, and other OSHA requirements?	
If there are injuries to the crew or the public during installation, who is responsible?	
Are there any legal requirements in connection with the removal of waste generated as a result of the installation and who is responsible for the costs to remove the waste and any compliance requirements?	
Will the installer or panel supplier have a lien on my property as a result of the project and if a supplier or subcontractor files a lien against my property who is responsible for obtaining a lien release?	
Will a Uniform Commercial Code financing statement be filed related to the rooftop solar system and related agreements? Who is responsible for terminating or releasing those filings at the end of the project?	

Post-construction/operating period considerations	Notes
Who is responsible for post-installation roof inspection?	
Who is responsible for post-installation roof repair?	
Who is responsible for washing or cleaning the panels if they become dirty?	
If there are structural damages other than to the roof resulting from the installation, who is responsible?	
If there are indirect or consequential damages and costs, such as ceiling damage, electrical system failures or interruptions, or water damage from leaks arising out of or in connection with the installation, who is responsible?	
If there is a hardware warranty issue, who is responsible for the costs of removing the old panel and installing the replacement panel?	
If there is a warranty issue, can you coordinate repairs or do you have to let the manufacturer or installer have an opportunity to resolve the issue first?	
Who is responsible for removal and reinstallation of the system when your roof needs to be replaced or repaired?	
Who is responsible for equipment replacement while the hardware is under warranty?	
What ongoing access rights must the property owner grant in connection with the ongoing maintenance, repair and operation of the rooftop solar system? Who provides notice and what other provisions apply if the installer or government entity inspector needs access to your home?	
Who is responsible for ongoing maintenance and meeting maintenance standards?	
Who is responsible to submit all necessary applications and paperwork to obtain the applicable tax credits, renewable energy certificates (green tags), rebates and other financial and tax incentives, if any? If the property owner is responsible, is the installer required to provide costs and other information that may be required to apply for such credits and benefits?	

Post-construction/operating period considerations (cont.)	Notes
Who owns and controls customer data derived from the installation? What information, if any, does the homeowner and the installer, panel supplier, or operator require the other party to keep confidential?	
Will the party operating and maintaining the system have insurance protecting the homeowner in the event of damage or injury caused by such party?	
Is the installer's contract over the life of the installer's warranty enforceable?	
Is the hardware manufacturer's warranty enforceable by the homeowner and/or the installer?	
If there is a catastrophic event (tornado, fire, hail damage, etc.), who pays for the loss? What happens to the lease or the contract?	
Who is responsible for enforcing the installation and hardware performance guarantees? Which party is actually responsible if the system does not meet or exceed such guarantees?	
What are the consequences and remedies if the solar panel manufacturer or installer goes out of business?	

Cost/benefit considerations	Notes
How good or poor is the expected annual solar resource for my property? What other structures or shade may interfere now or in the future with my rooftop solar system?	
What financial assumptions regarding future utility bills/costs were used when determining the expected life-cycle benefits of the installation?	
What assumptions regarding continuation and terms of net metering were used in determining life-cycle benefits of the installation?	
What payments do I receive if I generate more electricity than I use during the applicable period? What rate do I pay for electricity when my rooftop solar system does not generate enough electricity to meet my electricity need for the particular period?	
What assumptions regarding tax credits and energy production curves were used in determining life-cycle benefits of the installation? Does the assumption show a decrease in the output in future years as a result of the expected degradation in the efficiency of the solar panels?	
What is the installed-cost comparison of leasing versus owning the system?	
If you lease a system, who owns any renewable energy credits, green tags, rebates or other tax benefits, if any, associated with the system?	
What effect, if any, will the rooftop solar system have on the resale value of my home?	

Lease vs. own considerations	Notes
If you lease a system, does the structure of the lease comply with state laws? For example, in some states installment-based leases comply but those based on the amount of energy generated violate state laws.	
If you lease a system, can you buy it before the end of the lease term?	
If you lease a system, who owns it at the end of the lease?	
If you lease a system, who pays to remove it and repair the roof at the end of the lease – what if the lease is terminated earlier as a result of a default/breach by one of the parties?	
If you lease the system or have ongoing payments or benefits, who makes the calculations, does the information come from meters or other equipment or is it estimated and can the calculation change during the term of the lease?	
If you lease a system, who pay the taxes on it? Who pays the increase in real estate or personal property taxes, if any, attributed to the installation of the rooftop solar system?	
If you lease a system and decide to sell your property, what happens to the lease?	

Among Rocky Mountain Power's priorities are customer service and environmental respect and this document is intended to advance those priorities. If you are doing any work on your home or its energy system, it's important to understand all the potential costs, benefits and risks, the terms of your contract(s) and the allocation of responsibilities between you and your contractor(s). This list of considerations with respect to rooftop solar is intended only as a general starting point of questions for interested property owners to think about.

Rocky Mountain Power is making this document available on its website to assist property owners as they evaluate a potential rooftop solar installation. Rocky Mountain Power is not recommending or advising persons either to install or not to install rooftop solar, as that decision is personal to each property owner. Rocky Mountain Power cannot, and is not, providing legal or investment advice in this document. Installation of a rooftop solar system can be a significant investment and major alteration to a person's property. Rocky Mountain Power desires that its customers make an informed decision based on accurate and thorough facts and assumptions and it is Rocky Mountain Power's hope that this document will assist our customers in that regard. Rocky Mountain Power cannot resolve disputes between customers and distributed generation contractors or installers.

ROCKY MOUNTAIN POWER

Let's turn the answers on.

Exhibit 6

MidAmerican Energy Company's

Thinking About Rooftop Solar Checklist

CUSTOMER SERVICE

Thinking about rooftop solar?

Use this decision-making checklist to help understand the process:

Consideration	Homeowner Responsibility	Installer Responsibility	More Information Needed
Who is responsible for obtaining permits and authorizations?			
Who is responsible for post-installation roof inspection?			
Who is responsible for post-installation roof repair?			
If there are structural damages other than to the roof resulting from the installation, who is responsible?			
If there are consequential damages, such as ceiling damage, from the installation, who is responsible?			
If there are injuries to the crew or the public during installation, who is responsible? Does my homeowner's association or another entity have covenants or restrictions with respect to installing rooftop solar?			
What safety standards must be followed and who provides oversight?			
Who is responsible for removal and reinstallation of the system when your roof needs to be replaced or repaired?			
If there is a warranty issue, can you coordinate repairs or do you have to let the manufacturer or installer have an opportunity to resolve the issue?			
If there is a hardware warranty issue, who is responsible for the costs of removing the old panel and installing the replacement panel?			
Who is responsible for equipment replacement while the hardware is under warranty?			
What are the consequences and remedies for the installer's warranty if the installer goes out of business?			
What are the consequences and remedies for the hardware warranty if the hardware manufacturer goes out of business?			
Who is responsible for the lien disclosure?			
What are the insurance requirements to have a system on your home?			
Who is responsible for satisfying applicable electric codes for any existing and new wiring?			
Who provides notice and what other provisions apply if the installer or inspector needs access to your home?			
Who is responsible for making sure the installation meets any applicable fire department policies?			
Who is responsible for ongoing maintenance and what are the maintenance standards?			
Who controls customer data derived from the installation?			

(continued on next page)

CUSTOMER SERVICE

Thinking about rooftop solar?

Use this decision-making checklist to help understand the process:

Cost Considerations	Notes
What financial assumptions regarding utility costs were used when determining life-cycle benefits of the installation?	
What assumptions regarding tax credits and production curves were used in determining life-cycle benefits of the installation?	
What assumptions regarding continuation and terms of net metering were used in determining life-cycle benefits of the installation?	
What is the installed-cost comparison of leasing versus owning the system?	
If you lease a system, who owns any renewable energy credits associated with the system?	
If you lease a system, can you buy it before the end of the lease term?	
If you lease a system, who owns it at the end of the lease?	
If you lease a system, who pays to remove it and repair the roof at the end of the lease?	
If you lease a system, who pays the taxes on it, including any increase in property taxes?	
If you lease a system and decide to sell your property, what happens to the lease and the installation?	
If there is a catastrophic event, who pays for the loss?	

Among MidAmerican Energy Company priorities are customer service and environmental respect and this document is intended to advance those priorities. If you are doing any work on your home or its energy system, it's important to understand all the potential costs, benefits and risks, the terms of your contract(s) and the allocation of responsibilities between you and your contractor(s). This list of considerations with respect to rooftop solar is intended only as a general starting point of questions for interested property owners to think about.

MidAmerican Energy is making this document available on its website to assist property owners as they evaluate a potential rooftop solar installation; and MidAmerican Energy is not recommending or advising persons either to install rooftop or not to install rooftop solar – as that decision is personal to each property owner. MidAmerican Energy cannot and is not providing legal or investment advice in this document. Installation of a rooftop solar system can be a significant investment and major alteration to a person's property and MidAmerican Energy desires that its customers make an informed decision based on accurate and thorough facts and assumptions and it is MidAmerican Energy hope that this document will assist our customers in that regard. MidAmerican Energy cannot resolve disputes between customers and distributed generation contractors or installers.

Exhibit 7

National Renewable Energy Laboratory's

Homeowners Guide

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

TECHNICAL ASSISTANCE

Homeowners Guide to Leasing a Solar Electric System

This guide provides an introduction to solar leases for homeowners considering installing a solar electric system on their home.

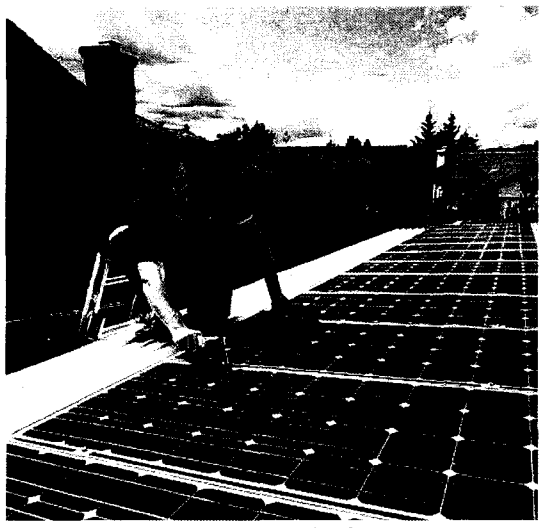


Photo from AstroPower, NREL 12342

Introduction

Solar electric systems, also known as photovoltaic (PV) systems, allow owners to generate a portion of their own electricity. Homeowners have several options in acquiring PV systems, and this fact sheet examines leasing a system. Analogous to leasing a car, solar leases provide a mechanism for the homeowner to obtain electricity generated from the sun without owning the PV hardware.

Solar leases are becoming more common. In 2012, more than 50% of residential solar electric system installations in most major markets were owned by third parties. In these agreements, homeowners enter into a contract with a lessor (the owner) of a PV system. The homeowners make payments to the lessor in exchange for use of the PV system for a specific period of time, typically 15-20 years. The PV system generates electricity that offsets the homeowner's energy use. In areas with net metering, excess electricity generated by the PV system may also be credited to the homeowner's electric bill. The lessor is responsible for the operation and maintenance (O&M) of the system and receives any applicable federal, state, and local tax benefits and incentives, including the Federal Investment Tax Credit of 30% of the eligible cost basis. Typically, the lessor also owns any renewable energy certificates (RECs) associated with the system. RECs certify that the electricity was generated with renewable energy, and the certificates can be sold or traded.

Leases offer many benefits to the homeowner. The traditional monthly payment lease requires little to no upfront costs. The lessor provides all O&M services associated with the PV system. In some cases, the homeowner's monthly utility bill savings can exceed the solar lease payments. Because monthly lease payments are either fixed or escalate at a known rate during the term of the lease, the lease also provides price certainty for the homeowner for a portion of the electric bill over a long-term contract. Leases may also allow homeowners to benefit indirectly from federal tax incentives, for which homeowners are otherwise ineligible. Solar leasing companies can access these incentives and pass along the savings via reduced lease payments.

Types of leases

Solar leases are similar to other types of consumer equipment leases, such as auto leases. The lessee pays monthly installments over the term of the lease. In some leases, the monthly installments may include an annual rate increase, known as an escalator. In addition to the typical monthly installment lease, there are also pre-paid and partial pre-pay leases. If a homeowner is willing to make an initial payment, this will decrease the monthly payment amount. However, there can be some consumer concern with fully pre-paid leases.

The benefits of leases for solar electric equipment include lower upfront costs and no operation and maintenance responsibilities.

When the homeowner makes a single payment upfront with no further monthly obligations, the solar provider has received all of its money at the outset of the transaction. Therefore, a concern is that the installer will have less incentive to provide

proactive O&M services to maintain the system. However, this risk is mitigated if the solar lease contains a performance guarantee. A performance guarantee is a commitment by the lessor to compensate the homeowner if the PV system fails to produce a certain minimum level of electricity. This compensation usually takes the form of a per-kilowatt-hour payment for every kilowatt-hour not produced below the guaranteed amount. Such guarantees can help ensure that the solar provider properly maintains the system.

The following terms are among those the homeowner will likely hear referenced by the installer.

Azimuth – An angular measurement, usually in reference to true north. In the northern hemisphere, south-facing PV systems generate maximum energy production, thus the ideal azimuth would be 180 degrees.

Inverter – Converts electricity from direct current (DC) to alternating current (AC).

Interconnection – The process of connecting a PV system to the electric grid.

Kilowatt (kW) – Unit of power equivalent to 1000 watts. Sizes of PV systems are expressed in kilowatts, e.g., a 10-kW system.

Kilowatt-Hours (kWh) – Unit of energy consumption. Homeowners are billed on a kilowatt-hour basis.

North American Board of Certified Energy Practitioners (NABCEP) Certified – A professional solar installer certification resulting from the completion of a rigorous examination process.

Net Metering – The regulation allowing the customer to receive credit for excess electricity not used by the home and returned to the utility grid. Net metering rules vary widely from state to state.

Operations & Maintenance (O&M) – O&M refers to the routine maintenance performed on the PV system, such as inspections and occasional cleaning. PV systems often require a new inverter after 10-15 years.

Performance Guarantee – Some leases may contain a clause that states the lessee will be compensated if the PV system does not meet a minimum kilowatt-hour production level in a given year.

Power Purchase Agreement (PPA) – A contract between a seller and buyer of electricity.

PVWatts – A simple performance calculator for grid-connected PV systems created by the National Renewable Energy Laboratory.

Renewable Energy Certificate (REC) – A REC reflects the environmental attributes of producing clean energy. RECs are priced on a megawatt-hour (MWh) basis.

Tilt Angle – The angle at which a PV array is set facing the sun relative to the horizontal position.

UL-IBEW Certification – As of October 1, 2012 the Underwriters' Laboratories (UL), announced an agreement to begin offering UL's Photovoltaic (PV) Installer Certification to members of the International Brotherhood of Electrical Workers (IBEW) union and the National Electrical Contractors Association (NECA). The collaboration will provide members access to a nationally recognized UL credential to improve market access to licensed, qualified electricians for safer PV installations.

Choosing a solar leasing provider

There are many factors to consider when selecting a solar leasing provider. Because this contract is a long-term commitment, it is important to read the lease proposal carefully to fully understand all requirements and responsibilities of the lease and to feel comfortable with the provider. Here are some questions to ask when choosing a provider:

- How long has the solar provider been in business and how many leases has it signed? Check the provider's standing with the Better Business Bureau or consumer protection agencies.
- Will a site visit be performed prior to the lease signing? With today's technology, solar providers can often evaluate your home's solar potential using tools such as GPS mapping, without performing a site visit. However, a site visit may be required to evaluate potential shading of the PV system, the existing electrical system, the need for roof reinforcements, or other site-specific considerations that may affect the overall cost of your lease.
- Who will be repairing the system and performing O&M? Are the company and its employees NABCEP certified?
- Ask family and friends about their experiences with different solar providers. Ask for and follow up on references. Ask questions regarding the timeliness of the installation process and the quality of customer service received pre- and post-installation. Is the system performing as expected? Have questions and issues been addressed in a timely manner?
- Obtain at least three bids to compare the various aspects of the proposals, including costs, production guarantees, warrantees, availability of monitoring (and cost of this monitoring, if any), additional add-on costs for such things as trenching, electricity panel upgrades, roof type, roof height, etc. Be sure both components are covered by warranties—20 to 25 years for the solar PV panels, and 10 years for the inverter.

Evaluating lease costs

Leases provide savings for the homeowner when the total cost of the lease is lower than what the homeowner would have paid to the utility for an equivalent amount of electricity over the lease term. This means homeowners must understand the full cost of the lease as well as their expected utility costs in the future.

1. ***Break down the full cost of the lease.*** This includes any upfront payments, as well as monthly payments. Some leases include an annual escalator in monthly payments. Keep in mind that one lease proposal may differ from proposals given to other nearby homeowners. Various factors affect lease pricing and terms, including the homeowner's credit rating, roof condition, roof orientation, electrical infrastructure onsite, local incentives, etc. Homeowners may also receive a discount by agreeing to make automatic payments from their checking accounts.

An Example of Solar Lease Costs[1]

System size	4 kW
System price bid	$16,000
Federal tax credit return to solar lessor	$4,800
Monthly solar lease payments by homeowner	$88 [2]
Homeowner's historic monthly electric bill	$147
Homeowner's monthly savings	$59
Lease term	15 years
What happens at end of solar lease?	Homeowner can purchase the PV system at a depreciated value or they can have it removed.

[1] Data representative as of January 2014

[2] This example assumes that the 4-kW system produces all electric power used by the homeowner

2. ***Confirm whether any upgrades are required.*** Depending on the age and condition of the homeowner's roof and electrical infrastructure, upgrades may be required to accommodate the PV system. These costs may be included in the overall lease cost.

3. ***Understand the estimated production of the PV system.*** The solar provider will provide an estimated production for the system and often times, a performance guarantee. Homeowners can verify these estimates themselves using simple production calculators, such as the PVWatts 3 Calculator. Often the system guarantee is based on PVWatts.

4. ***Understand your current electric rates.*** Electric rate tariffs can be complicated. It is important to understand the cost of energy that will be offset by the PV system. It may not be as simple as dividing the total electric bill by the kilowatt-hours used in a given month. Rates may change monthly, seasonally, and/or depending on the time of use or how much is used. Some costs included in your monthly bill may be fixed and may not be offset by the PV system. Many utilities provide information on their websites that helps decipher all charges applied to a homeowner's electric bill. Check with your electricity provider for more information regarding your energy rates.

5. ***Evaluate assumptions regarding future rate increases.*** The estimated energy savings quoted in your lease proposal may depend in part on expected future utility rate increases. Residential electricity rates in the United States have increased an average of 3% annually over the past 10 years. In recent years, rates have been flat in many parts of the country. The increases vary greatly by location and utility provider. Future utility rates are difficult to predict because they are influenced by many different factors. Historical increases may not be an accurate predictor of future energy rate increases. The U.S. Energy Information Administration provides forecasts of retail electric rates for the next 1-2 years by region in its Short Term Energy Outlook.

6. ***Evaluate any additional assumptions the solar installer is making in the proposal.*** For example, a solar installer may include an assumption about an increase in property values as a result of installing solar as a component of the total return on the investment. In addition, consider any potential impacts to your homeowners' insurance rates or property taxes to fully understand all of the costs and benefits of installing a PV system.

7. ***Compare the lease to other financing options.***[1] Solar leases are just one of a number of financing options available to homeowners. Once you have received your lease proposal, it may make sense to compare it to other financing options for your PV system, such as a direct system purchase from a local installer, or other options such as participating in a community solar program. If a prepaid lease is under consideration, evaluate the opportunity cost of the prepayment. Would this prepayment be better spent on another project? Online tools exist to allow homeowners to learn more about solar and compare available options. Homeowners may also enter into a power purchase agreement (PPA) with a PV system owner. Similar to leasing arrangements, with a PPA, the PV system is owned by a third party. In these agreements, homeowners do not lease the PV equipment but instead purchase the output of the PV system on a per-kilowatt-hour basis, rather than paying a fixed monthly fee. Under a PPA, the homeowner only pays for the energy produced by the system.

Key lease terms and conditions

Homeowners may want to clarify the following points with a solar leasing company before signing a solar lease.

- What's included in the typical lease package? Your solar provider may require you to sign multiple documents, including the lease agreement, documents related to the sale of renewable energy certificates, net metering, and interconnection agreements, etc.
- What happens if I move, sell my house, or need to terminate the lease? Leases typically allow for a few options in the event you decide to sell your home. You may transfer the lease to the new buyer. The new buyer will need to meet the credit requirements and be approved by the solar provider. Another option will be to pay off the lease and add the value of the PV system to the home's asking price. Some providers may also allow you to relocate the system to your new home as long as you pay the cost of the move.
- What happens if I need to replace the roof? In the event that a roof replacement is required during the term of the lease, the homeowner may be required to pay the solar provider for removal, storage, and reinstallation of the PV system. Depending on the age and condition of the roof, it may be wise to replace the roof prior to the installation of a PV system.

[1] For more information on financing options, visit: http://www1.eere.energy.gov/solar/pdfs/48969.pdf

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- What happens at the end of the lease term? Leases typically offer three different options at the end of the lease term. Homeowners may 1) renew the lease, 2) request the PV system be removed, or 3) purchase the system at fair market value. Fair market value is a price determined by a third-party appraiser at the time the system is sold.
- Who is responsible for O&M? Who do I contact if there is a problem with the PV system? Typically O&M is included in the lease payments. O&M may be provided by your solar provider or a third party. The lease documentation should be clear regarding who to notify if there is a problem with the PV system. The homeowner may be required to notify the solar provider within 24-48 hours of detecting an issue.
- What are the insurance requirements? As the system owner, the lessor is responsible for insuring the PV system. However, the homeowner may also be required to have a minimum amount of insurance coverage on the house and/or add the lessor as an additional insured party.
- Is there a performance guarantee? How is it established and what happens if the system does not perform as expected? The performance guarantee should state how the homeowner will be compensated if the system does not produce as much energy as expected. Be aware that solar modules degrade (i.e., produce less electricity) over time. Typical degradation rates are assumed to be 0.5% annually.
- What happens if the provider goes out of business? As with any long-term transaction, there is a risk that your provider will go out of business. It is possible that the original lessor will sell your lease to a third party investor (not unlike when a home mortgage gets sold by one company to another). In that case, the investor will still likely have a vested interest in the operation of the PV system and would likely seek out a new O&M provider to continue to service the leases. Because solar leases are still relatively new in the marketplace, there are a few instances where providers have gone out of business, but to date those instances appear to be isolated cases involving small-scale providers.
- Can I monitor the production of the PV system? Many solar providers offer homeowners access to an online monitoring system that tracks production of the home's PV system. This may be free or may involve an ongoing fee.

NREL's solar deployment and market transformation assist the market by applying our expertise and knowledge to address market barriers to solar technology development.

NREL's mission is to be the leader in technology innovation and to advance renewable energy efforts around the world. Let NREL help propel your organization toward a more sustainable energy future.

For more information about NREL's range of deployment and market transformation activities, visit our website at *www.nrel.gov/tech_deployment.*

Additional Resources:

Solar Leasing for Residential Photovoltaic Systems http://www.nrel.gov/docs/fy09osti/43572.pdf

Estimate energy production from PV systems http://www.nrel.gov/rredc/pvwatts/grid.html.

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Exhibit 8

Louisiana State University AgCenter's

Consumer Guide

Solar Power for Your Home

A Consumer's Guide

LSU AgCenter
Research · Extension · Teaching

Acknowledgments

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Table of Contents

Are you thinking about adding a solar energy system to your home to generate electricity? If so, this consumer guide will help you explore various options, ask important questions and make a well-informed decision.

Photovoltaic or PV, systems convert light energy to electricity. Other solar energy technologies, such as solar water heating systems, work by capturing and redirecting heat from the sun, but this guide is focused on systems to generate electricity for your home.

Although photovoltaic technology has existed for decades, its use in both rooftop solar and community size solar systems has been rising nationwide. Solar power offers valuable benefits, but there also are many things to consider when thinking about a solar photovoltaic system.

Why Go Solar?

The sun is a renewable source of clean energy and that's an increasingly valued benefit. Solar photovoltaic (PV) systems produce electricity without emissions of air-polluting gases, greenhouse gases and particles that are byproducts of combustion or burning fuels. The supply of "fuel" for solar PV systems – sunlight and solar heat – is endless and free. That doesn't mean the electricity is free, but you may be able to save money.

With the ongoing advancements in solar PV technology, the cost of solar power continues to drop and its use is on the rise. Since solar PV systems are long-lasting and require little maintenance, the cost of producing electricity remains relatively stable and predictable over a long time. Owning a home solar power system can be insurance against energy cost increases that affect other power sources. In addition, studies in various locations found that homes with PV systems sold for several thousand dollars more than comparable nonsolar homes.

Rooftop solar power creates a system of ***distributed generation*** (many small-scale power plants) that helps meet area power needs. Solar power that is produced at times of high electricity demand (typically late afternoon) is high-value electricity since it offsets energy purchase or generation when the cost is higher.

You may have personal motives to go solar. You may want to reduce your energy bills and/or increase your property value. You may like the idea of producing some of your own power at home. You may value the opportunity to do your part to conserve energy and promote environmental quality by using an eco-friendly renewable energy resource.

Because of these benefits and to promote energy resource diversity and green economic development, solar energy use is encouraged by public policy. There are many financial incentive programs to spur development of renewable energy, grow green jobs and make it more affordable for you to go solar.

Despite the benefits, there are several factors that can limit home solar power:

- Cost is the primary hurdle for solar power systems at every home. A solar system that can power a home is expensive. Financing may not be available or affordable or the homeowner may not qualify. Finding and evaluating financing options can be an intimidating and confusing process.
- Solar energy isn't continuous, since it's not available at night and is reduced greatly when it's cloudy or the panels are snow covered, shaded or dirty. As a result, another source of electricity must be ready to provide power whenever it's needed (such as an electric utility company, whole house generator or a large and expensive battery storage system). Also, rooftop solar is not equally effective in all areas and climates.
- Rooftop solar isn't feasible when neighboring structures or landscaping block access to sufficient sunlight exposure. Some roofing types, designs or orientation limit installation or efficient output.
- Solar access rights and regulations vary widely. Many states and cities protect solar access rights, but some local ordinances and/or homeowners association rules restrict installation of solar systems on homes to maintain an established aesthetic standard.

7 Basic Steps To Going Solar

1. Get a home energy checkup.
2. Complete cost-effective energy-efficient home improvements.
3. Understand your utility bills, local incentives (tax credits, rebates, etc.) and rules.
4. Explore solar system types and your available solar access.
5. Weigh buying versus leasing considerations.
6. Get proposals from several reputable, established solar system providers.
7. Analyze costs, projected savings and contracts to make the best choice for you and your home.

When Should I Add a Solar Power System to My Home?

Even though solar energy offers many benefits, a rooftop solar power system is not the first step to saving energy, money and the environment. If your home wastes energy, improving its energy-efficiency should be your first priority.

An energy-efficient home reduces the amount of power you use from any source, so efficiency trumps renewable energy in being good for the environment, conserving nonrenewable resources, helping our nation's energy security and keeping more of your money for other things. A "high performance" home also could provide many other advantages such as greater comfort, quality, durability and indoor air quality.

It usually doesn't make good economic sense to install a rooftop solar system until your home is reasonably energy-efficient. Otherwise, you're spending money to produce electricity that you would not need if your home were more efficient. Investing in an effective home energy upgrade typically produces a greater return on investment and costs less than a solar power system for the same reduction in electricity use. Moreover, increasing the energy efficiency of your home reduces the size (and cost) of the solar system needed to supply your power needs.

An exception to this general rule would be when major solar incentives are available but will soon expire or may be reduced. In such a case, it may be reasonable to first install a solar energy system that can supply up to half of your annual power need so you can take advantage of the incentives while they are available. That would leave room to still increase your home's efficiency up to 50 percent, so you could make the energy improvements afterward and reap the full benefits of efficiency plus solar energy.

So, Before You Go Solar...

Learn about the most effective ways to increase your home's energy efficiency in your climate at www.energystar.gov, www.energy.gov and www.eXtension.org. To optimize the efficiency of your home and get the most "bang for the buck" without creating air quality or moisture problems, it can be helpful get a customized home energy checkup, home performance improvement plan and quality assurance testing by a trained home energy professional. You can find certified home energy pros at www.resnet.us and www.bpi.org. Find out if your local utility company offers energy efficiency programs, home energy assessments or discounts or rebates for energy-saving appliances, home improvements or new homes.

If you're planning a new home and want to include solar power, consider building a "*zero-energy ready home*" with an experienced high-performance home builder. For reliable information on high-efficiency building systems, technologies and detailed guidance, explore the Building America Program *Solution Center* at https://basc.pnnl.gov.

Analyze Return on Investment (Savings and Payback)

By combining energy efficiency and a home solar power system, you could potentially produce much or all of the electricity you use on an annual basis. Whether you purchase or lease a home solar energy system, you're making a major long-term investment and should analyze all costs and likely savings or payback before making a decision.

Consider:

- Available tax credits, rebates and incentives from all available sources.
- Initial cost (equipment, installation, permit fees) or monthly costs (loan or lease payments) for the expected equipment life or lease term.
- Maintenance costs (monitoring, inspection, cleaning, landscape pruning, removal to reroof, etc.).
- Replacement costs of system components (inverters, batteries, etc.) with a shorter lifespan than the solar panels.
- Your average and annual electricity use and cost per kilowatt-hour, both current and projected.
- How much electricity per year the system is expected to produce.
- The rate or credit you will receive from the utility company when your system produces more energy than you use.
- How the solar system is likely to affect your home's appraised market value and how long you plan to stay in the home.
- The expected productive life of the solar power system or the length of the lease contract.

It can be tricky to calculate the return on a home solar investment, especially if leasing or financing a system. Purchased rooftop solar payback periods can range from seven to 20 years without incentives. Incentives shorten the time it takes to recoup the cost and see real savings.

You also may wish to consider timing for a solar investment. As costs of solar power systems decline, efficiencies increase and utility electricity costs rise, the payback period gets shorter. After a solar power system is installed, it may be impractical to upgrade the system to take advantage of a newer, improved technology.

Find Incentives

A variety of incentives may be available to you that lower the cost or increase the return on investment for a home solar energy system. Common incentives include income tax credits, property tax exemptions, rebate programs from government agencies or utility companies, payments or credits based on electricity production, grants, loans, net metering policies and others. They vary by state and city and by whether the system is purchased or leased and they may change or expire.

Fortunately, there is an easy way to find incentives! Visit and browse the **Database of State Incentives for Renewables and Efficiency** at www.dsireusa.org to explore summaries of renewable energy and energy efficiency financial incentives, programs and policies available at the federal, state and local levels. Because new programs are formed frequently and not all may be listed, it's a good idea to check the database and your local utility provider periodically to find out what's available to you. Likewise, many incentives may change or phase out as the renewable energy industry grows and the technology becomes increasingly productive.

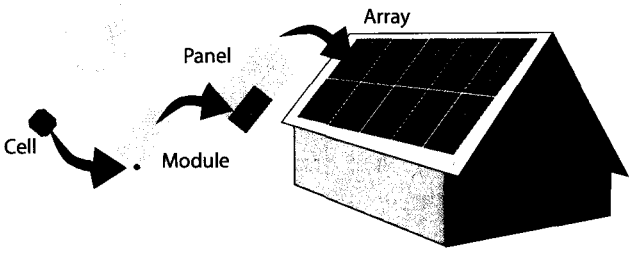
Examples from DSIREUSA.org (in 2014)

1. Click on View Federal Incentives, then on Residential Renewable Energy Tax Credit to see information about the 30 percent federal tax credit available until Dec. 31, 2016. Click on your state to find available residential incentives and programs. For example:
2. If you click on Arizona, then narrow your search to see Residential Incentives Only, in 2014, it revealed:
   - A personal tax credit of 25 percent of cost of solar and wind devices, up to $1000.
   - An energy equipment property tax exemption of 100 percent of increased value.
   - A solar and wind equipment sales tax exemption.
   - Numerous utility rebate and loan programs. Several cities with green building and rebate programs.
3. If you click on Louisiana, in 2014, it revealed a variety of state and local financial incentives, including the state personal tax credit for solar energy systems on residential property.
   - Until 2018, homeowners can use a state tax credit (refunded even if in excess of taxes owed) of 50 percent of the first $25,000 spent to buy solar technologies, in addition to the 30 percent federal income tax credit. Using the state and federal tax credits, a home system valued at $25,000 can be purchased for about $5000.
   - If the solar system is leased, however, the leasing company receives a smaller tax credit.

What Is in a Home Solar Photovoltaic (PV) System?

Solar PV Basics

The basic unit of photovoltaic or PV, technology that converts light to energy is the ***solar cell.*** Multiple solar cells are connected and sealed together to form a PV ***module.***



The power-generating components of a solar photovoltaic system.

Solar ***panels*** include one or more PV modules assembled as a pre-wired unit. In most systems, several solar panels are linked to provide the desired power capacity, typically measured in kilowatts. The complete set of panels that form the entire power-generating unit is called the PV ***array***. Most home PV systems are assembled as an array of multiple panels attached to the roof, so they are often referred to as a "rooftop solar system," even though the array can be installed on a free-standing frame or other structure on the property.

A PV array typically includes a mounting system attached to the roof and one or more ***inverters*** to convert the electricity it generates from direct current (DC, the type from batteries) to 120 volt alternating current (AC, the same as the electricity delivered to your home by your utility company). A central inverter system normally is sized for the entire array.

Microinverters are an alternative approach to the single-inverter system commonly used on homes. Each microinverter operates with a single PV panel or module and connects to other independent units. This allows for simple future system expansion – without the need to change out much of the existing system – and provides improved installation and fire safety. It also avoids the possibility of being completely without solar power if an inverter fails and has a less expensive replacement cost than a single-inverter system.

With a single or central inverter, if one panel is shaded or malfunctions, that can greatly reduce the entire system's output. With microinverters, only the affected panels reduce output while the rest of the system continues full power production.

The conversion of power from DC to AC by the inverter consumes some of the solar power that has been produced. There is less energy loss when solar PV directly powers DC or "solar ready" appliances and equipment. LED bulbs and many electronics (computers, TVs, mobile phones, etc.) are powered by DC electricity, as evidenced by the AC to DC inverters commonly visible along the cord for those devices. Any direct DC interaction between a solar PV system and its connected equipment may require additional control devices and wiring.

In the future, homes may come with dual current electrical networks where a dedicated DC nanogrid or microgrid uses solar electricity and batteries to directly power solid state lighting, cooking, refrigeration and telecommunications alongside the typical utility connected AC macrogrid.

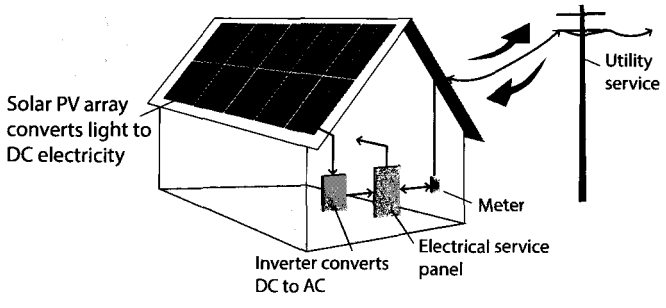
Types of Home Solar Power Systems

The two basic types of home solar photovoltaic (PV) systems are stand-alone, also known as **off-grid** and utility-interactive, also known as **grid-tied.**

Off-grid or stand-alone systems are not connected to a utility power grid. They include a battery bank that is large enough to power the home at night and during extended periods when the panels don't receive sunlight. This adds substantial cost and maintenance requirements to a PV system but can be a more cost-effective alternative to having new utility lines extended to remote locations. Off-grid systems also can be designed to serve as a backup power system in place of fuel burning generators.

Battery bank for an off-grid home solar power system.

Grid-tied or utility-interactive systems are connected to the electric utility lines and are the most common and practical systems for most homes at this time. The solar electricity produced is supplied to the main electrical panel of the house, offsetting the purchase of power from the utility company. Since the home is still receiving some power and continuous power-support services from the utility, there will still be a monthly electricity bill (yet less than before).



Grid-tied home solar power system.

Additional meters may be installed or the original electric meter replaced with a "smart" digital meter, to separately measure power from the solar panels and electricity from the utility company. Some meters also can measure time of use for variable rate structures.

There are several important **benefits** to grid-tied systems versus off-grid systems:

- They are considerably less expensive, safer and require less maintenance. There is no need for a suitable safe storage space large enough for the battery bank.
- They combine solar power with the consistency of utility generated electricity to produce enough power to meet all needs, even when the solar system is not producing power.
- In most areas, surplus energy produced when the sun is shining (in excess of your home's use at the time) can create a credit on your utility bill.

At this time, most grid-tied systems are required by building codes to automatically shut down whenever there is a grid power outage. This is a safety measure to protect power-line workers and neighbors on the same utility circuit. That means your solar system does not provide power when the grid is down, contrary to what many assume.

Hybrid systems and new inverter technologies that allow the home to use solar power during a grid power outage are becoming available. Such a system would provide a valuable backup power system during daytime.

- *Emergency power inverters* are grid-tied inverters with a feature that allows a small amount of power to be drawn to a dedicated outlet when the grid is down. The solar electricity cannot be delivered through the building's wiring system, so it can't power major loads but can provide critical daytime charging of electronics and other small power needs.
- *"Islandable"* PV systems use a small battery bank, a bimodal battery inverter and sophisticated controls that can allow most or all of the solar system capacity to be used when the utility grid is down and the sun is shining.
- *Smart inverters* can receive and respond to grid signals to help keep the power grid stable. Inverters that can safely disconnect from the utility grid during a power outage but retain the ability to convert DC electricity into usable AC electricity for the entire home (without batteries) are in development and may soon be commercially available.

Bidirectional battery storage or inverted demand is an emerging alternative approach. As the technology matures, it could provide backup power to a building (with or without a solar photovoltaic system) and contribute to some of the goals of using solar energy. Batteries connected to the grid and charged at low demand times (night) could reduce peak demand during the day (when grid power is more costly). When there is a variable utility rate structure by time of day (higher rate at peak demand times), a bidirectional battery storage system could provide lower electricity costs for the customer, reduce peak demand costs for the utility and help conserve energy.

Net Metering

When a grid-tied home solar PV system produces more power than is being used, surplus power is fed into the utility grid. Net metering is a solar incentive designed to increase the return on your investment in a PV system by crediting your bill for this surplus power at a predetermined rate.

Net metering legislation or regulations have been enacted by most states to jump-start renewable energy development, but policies vary by state. Net metering policies usually require electric utilities to effectively "run the meter backwards" when an eligible customer's PV system is producing more electricity than the home is using. With net metering, you are billed for the net amount of electricity you used during the billing period. In other words, you pay the difference between the electricity coming from the grid and the electricity you put back into the grid.

Depending on local policies, net metered customers may be paid or credited the full retail rate for surplus power they supply to the grid, while some may instead be paid or credited a lower wholesale rate. The wholesale rate is what the utility pays for other sources of electric power. It reflects the lower cost of producing power in bulk due to economies of scale. The retail rate includes the cost of generating power plus the fixed cost of the grid system (power lines and distribution system) that delivers power to and from each user. The retail rate also may include the cost of utility incentive and social programs.

When net metering applies retail rates for surplus power supplied to the grid, net metered customers avoid the fixed cost charges that support the power grid and programs. Since grid-tied solar customers rely on the grid network, some states have amended net metering or are considering policy changes that require everyone who uses the electric power grid to support its cost. This may take the form of a one-time fee, periodic surcharge or rate adjustment. Check with your local utility to find out how these policies would apply to you and evaluate how it would affect the return on your solar investment.

There is wide variation in state net metering policies and limitations. For example:

- Net metering **eligibility may vary** by system capacity, system type, customer category (residential, commercial, industrial), type of utility or how surplus power is handled in a billing cycle. Some states use a dual metering system. Also, many policies evolve over time. It's a good idea to evaluate how potential rate policy changes would affect your solar investment.
- Some policies include **net metering caps** at a certain percentage of a utility's power generation, solar system size or other limit. The purpose of caps is to limit the incentive to early adopters. When the cap is reached, new solar system households may receive the wholesale rate for their surplus power instead of the retail rate.
- Instead of net metering, some states and cities use a **feed-in tariff or FIT,** where the electricity used and the electricity generated by a customer are measured and priced separately. In such a case, you would have two meters, so all the electricity your solar system generates is metered separately from your home electricity consumption. You provide electricity from your PV system directly to the utility grid in exchange for a contract rate and you separately purchase electricity from the utility at the retail rate. A feed-in tariff may require the utility to credit rooftop solar power at a fixed (or decreasing over time) price that is higher than the retail rate, usually over a fixed time period.
- Some states have **carry-over credit limits** (such as surplus power credits are forfeited at the end of every 12-month period) to discourage oversizing of rooftop solar power systems.

Check www.dsireusa.org to find your state and utility company's current net metering or FIT policies, but don't assume current policies and rate structures always will remain the same. Since many states revise their initial policies, it's wise to check periodically and evaluate your solar investment knowing that rate policies could change. Policy changes to tariff rules or minimum monthly bills that occur can apply to you, even after your PV system is installed.

Community Solar or Renewable Power Programs

If you'd like to support and use renewable energy without adding power-generating technology to your home, check to see if your utility company offers a voluntary utility **community solar** or **renewable power** program. Such programs are becoming more widely available.

In community renewable power programs, you can choose to participate and purchase electricity generated by renewable resources such as solar, wind and methane gas from decomposing garbage. The rate per kilowatt-hour typically is a little higher than the rate for fossil fuel

generated electricity but with no investment in home solar equipment. Customer participation encourages investment in community renewable energy systems that can more efficiently produce power than small home systems.

Benefits of Community Solar

Utility scale solar is less expensive to construct than rooftop solar and savings can be passed on to customers.

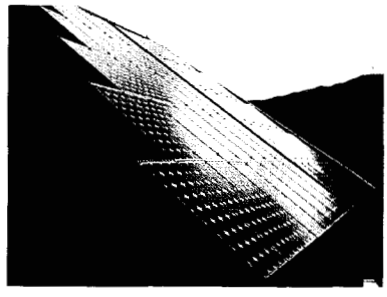
It provides access to renewable, clean energy to households who are not in a position to install home solar power systems because of:

- Insufficient sunlight access due to unsuitable weather, obstructions, roof type or orientation.
- Living in rental property.
- Income or credit score limitations.
- Not planning to stay in the home long enough to justify the investment.
- Not wanting the responsibilities of choosing and owning a solar system.

Types of Solar Photovoltaic Technologies

Crystalline Solar Cells – Traditional, first-generation solar cells are made from silicon crystal. The vast majority of home solar panels now in use have crystalline cells.

- Monocrystalline cells generally are the most efficient type (they produce more power per cell). They also are the most energy- and time-intensive to produce, so they tend to be the most expensive type. Their sunlight to electricity conversion efficiencies tend to fall in the range of 13 percent to 20 percent, with useful life spans of 25-35 years (based on rate of output degradation). Technology advancements are increasing the potential efficiencies.



Monocrystalline solar panels.

- Polycrystalline cells, made up of many smaller crystals, cost less and provide a similar life span, but they deliver slightly lower efficiencies in the range of 10-16 percent. With these, you might need to cover a larger surface area to get the same output you would get with a monocrystalline solar array. Advancements are increasing efficiency closer to that of monocrystalline cells, however.

Thin Film Solar Cells – Second-generation thin film solar cells are made from noncrystalline layers of semiconductor materials so thin that they are flexible. The market for thin film technology has been growing.

Thin film solar materials.

Because of the flexibility, thin film solar cells can be used in ways rigid crystals cannot. This film can be made to double as roofing shingles or tiles, to form adhesive sheets that fit within ridges of metal roofing or even can be used as glazing of skylights and building facades. This offers an attractive building-integrated option, often referred to as a BIPV (building integrated photovoltaic) system. Thin film also can be manufactured in metal-framed panels similar to crystalline cells.

Thin film can be produced faster and is less expensive than crystalline cells, but it has a lower efficiency – in the range of 5-9 percent – so about twice the surface area is needed per watt of power. Future efficiencies could increase its efficiency to 10-16 percent with technology advancements.

Despite the lower efficiency, thin film can use diffuse sunlight better than crystalline cells, is less prone to overheating (good for warm climates), is more shade tolerant and may be more resistant to hail damage. That can help improve output when the solar orientation is not optimal. Thin film output tends to degrade faster than crystalline cells, although some types now have 20-year warranties.

Future Technologies – There are other technologies being developed to harness the energy in sunlight, such as using nanotechnologies or chemical processes. Such advancements could offer higher efficiencies, lower costs or new uses in the future.

Where Will My Home Solar System Work Best?

A solar photovoltaic system works best and delivers the most power where the most sunshine strikes its collection surfaces. Mid-day sun produces more power than early morning and late afternoon sunlight. Of course, sunny days produce more power than cloudy days, so the climate and daily weather matters. The clearness index is a measure of how much sunlight your climate receives.

Placement of Your Solar System

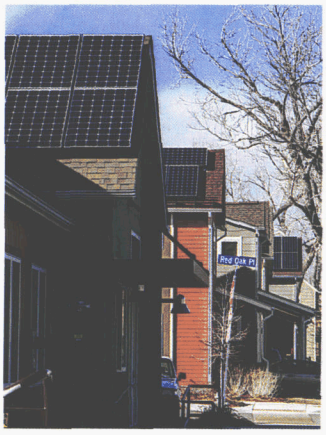
Orientation – Solar panels work best oriented toward the south. When that's not feasible because of the roof orientation or aesthetics, facing 45 degrees west or east of

true south reduces energy output by less than 5 percent. Facing 90 degrees off of true south reduces annual energy output by only 10-20 percent. So a roof that faces south, southeast or southwest is fine and a roof facing east or west may be acceptable, depending on your expectations for the system.

If your utility has a time-of-use rate system, it could make good economic sense to design your PV system to face west to maximize production in late afternoon when wholesale electricity prices usually are highest. Some utilities may offer incentives for west-facing solar placement that increase output during the late afternoon peak demand time. West-facing solar power systems can generate about 50 percent more electricity during late afternoon than south-facing systems.

Tilt – The slope or tilt of panels also affects performance. The optimal fixed tilt in the United States is an angle a few degrees lower than the geographic latitude, but an exact tilt is not crucial. A 15 degree variation to suit a roof's pitch makes almost no difference in power output. While it may not provide optimal capture of solar rays, most rooftop solar panels are mounted parallel to the roof for the sake of simplicity and aesthetics.

Tracking Arrays – The output of a solar power system can be increased by having the system track the sun as the sun moves across the sky on a daily basis, and/or adjust the tilt of panels to the seasonal solar path, instead of being fixed in one orientation. Tracking arrays are not generally recommended for home PV systems, however, because of the added complexity, maintenance and costs compared to the energy benefits.



Shading can greatly affect power output. Examine effects of seasonal sun angles, new buildings and growing trees.

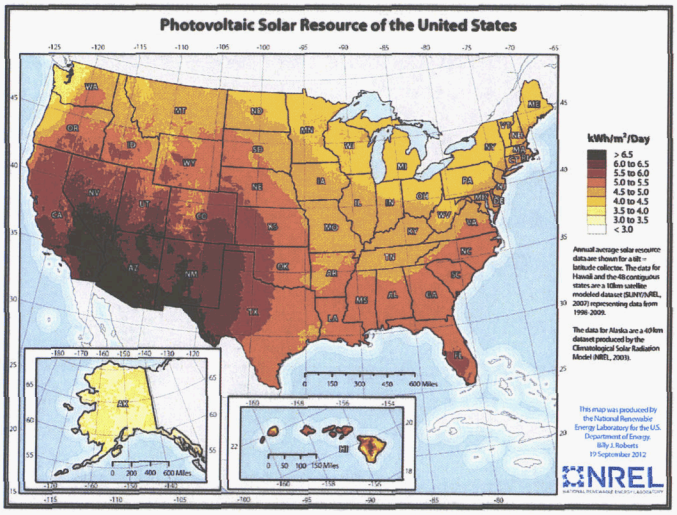
Shade – Shading can have a very large effect on the output of a PV system. Depending on the type of system, shade on 25 percent of an array could result in a 50 percent or greater drop in output. It's important to examine shading across the sun's path – not only in a day but also over a year since the angle of the sun is lower in winter. You should make sure your neighbor's house and trees won't shade your solar array in winter. Also, consider what might create shade in the future, such as growing trees or new buildings. It's a good idea to ask your neighbors if they have future remodeling or landscaping plans that could shade your solar panel location.

Many solar professionals use a tool called a solar pathfinder (www.solarpathfinder.com) to find optimal placement at a location. If seasonal shade is an issue, a microinverter system is preferred since only the shaded panels are affected.

Your Geographic Solar Resource

Your location and the weather have a big effect on your solar power output. For example, homes in the northwestern United States may average only three to four hours of sunlight a day, while those in the Southwest average six-and-a-half hours. That means northwestern homes need a larger and more expensive array to produce the same power as southwestern homes.

Look into your area's solar resource (how much sunshine is available). The U.S. Department of Energy's National Renewable Energy Laboratory creates color-coded maps that illustrate approximate sunlight received in kilowatt-hours per square meter per day. Visit www.nrel.gov and search "solar maps" to see more.



Source: National Renewable Energy Laboratory

HOW Do I Size, Install and Maintain My Solar System?

Sizing Your Solar Power System

Sizing your home solar photovoltaic (PV) system depends upon a combination of factors, including: the PV system's efficiency, your location (solar resource), placement, available roof space, your electricity use, your utility rate and your budget. You will need to balance how much you're willing to invest with how much of your electricity needs you want the solar system to supply. This will be an important discussion to have with knowledgeable professionals.

A solar photovoltaic system design should take into account:

PV Power Rating – Photovoltaic systems are rated with a peak DC power generating capacity measured in watts or kilowatts. A kilowatt is 1,000 watts. It's important to know the actual operating capacity usually will be less than the laboratory rated capacity, so that should be considered in predicted output.

Available Solar Resources – The sun does not always shine at its peak intensity and solar intensity is reduced when the sun's rays strike cells at an angle. To estimate the likely output of a PV system, a solar professional uses ***peak sun hours*** which is the number of hours the sun must shine at peak intensity on a solar array to equal the amount of radiation that actually was received by the array during the day.

PV Electricity Generation – To estimate the output a photovoltaic module will produce, the expected operating power capacity (kilowatts) is multiplied by time. There are free software programs available to help estimate the electricity output of a PV system.

To size your home solar power system:

- As a starting point, determine your total electricity use in kilowatt-hours for the past year (your demand). Check your electric bills or contact your utility company. Then you can compare how much a new solar PV system is expected to produce (in kilowatt-hours) with your annual electricity use.
- Check what you're paying per kilowatt-hour. U.S. electric rates in 2014 ranged from 7 cents to 38 cents per kilowatt-hour, with a national average rate of 13 cents per kwh. Compare your utility rate with the cost per kwh of solar power to evaluate cost versus benefit over the life of the system. Ask your utility about its historical rate increases and compare that to savings assumptions made by solar companies. (See *Solar Leasing Versus Ownership Calculators* section.)
- Consider how much of your energy use you want to produce with a home solar system. Measure your suitable unshaded roof area (Note: Solar panels can't be installed over roof vents, pipes and valleys). A small starter system might use only 50 square feet of roof area, where a large output system may need 1,000 square feet. A rough rule of thumb is 100 square feet of clear roof area for every kilowatt.
- If your roof limits the size of your system, you can choose high-efficiency crystalline PV panels. If you have ample roof area, you may opt for a lower efficiency, less expensive or more attractive thin film system.
- If you plan to use net metering or other incentives, check the rules for any size limitations.

The NREL PVWatts® Calculator
(pvwatts.nrel.gov)

This free online calculator can be used to help determine the energy production and cost savings of a grid-connected solar system. It estimates monthly and yearly energy production in kilowatt-hours and the energy's dollar value. You may select your location and use the default or choose actual values for your proposed system size, electricity cost, solar array type and panel tilt angle. The calculator also uses weather data for your location.

As an example, a 2014 Phoenix, Ariz., default calculation using a 4 kilowatt system with a 20 degree tilt and electric rate of 12 cents per kilowatt-hour produces a month-by-month estimate of solar radiation, AC energy (kwh) and annual electric bill savings of $828. A comparable calculation for Seattle, Wash., produces an annual electric bill savings of only $337.

Installation Considerations and Tips

A solar array can be **roof mounted, ground mounted** or **building integrated:**

Rigid crystalline solar modules can be installed on most any type of roofing, but some types are easier to deal with than others. Composition shingles are easy to work with; clay tile and slate are difficult and more risky (for roofing damage). Solar panels can be attached to the ridges of standing seam metal roofing so there are no penetrations in the roof.

Roof-mounted solar array for large power capacity.

- Most roof-mounted crystalline modules are installed on racks made of aluminum. Racks should create an air space of about 3-4 inches under the array to help lower the PV module temperature. Cooler modules produce more electricity than hotter modules.
- If your roofing is worn or aged, it should be replaced before installing the solar panels to postpone or avoid the cost of removing and reinstalling the solar

Crystalline solar modules mounted on aluminum racks, with airspace to keep them cooler.

system to reroof. The typical life of an asphalt shingle roof is 14 years in hot climates or up to 20 years in cooler climates.

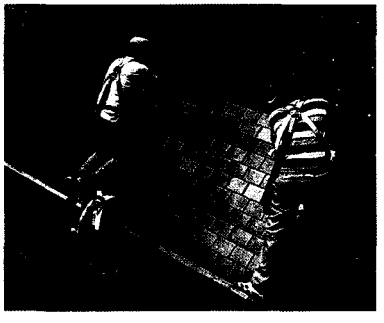
Another option is to completely cover a porch or patio with a solar array, without roofing underneath. There are several advantages to having a solar porch or patio covering instead of installing panels on the main house roof. It can create a more attractive architectural appearance. This placement avoids the need to remove and reinstall solar panels to replace roofing. It also can keep the panels cooler, which helps improve performance.

A solar porch or patio roof is an attractive option and avoids placement of system components over roofing.

Installing a ground-mounted or pole-mounted (also called stand-alone) array can allow optimal orientation and tilt when the house roof is less suitable. It can be made adjustable to vary tilt for the season. It also avoids two of the major drawbacks of a roof-mounted array – the potential for roof leaks at connection points and the need to remove it when the roofing needs to be replaced. It can be installed a few feet above the ground or raised high enough to use as a landscape shelter. But keep in mind that a ground-mounted array requires a site without any nearby trees or buildings to the east, south or west.

Ground-mounted solar array allows optimal tilt and avoids placement of panels over roofing.

There are expanding options for integrating thin film solar systems into a building itself. Solar shingles both blend in and have the benefit of offsetting the cost of roofing material. Adhesive PV sheets can fit between metal roofing ridges, blend in color and require no penetrations in the roof.



Thin film solar shingles can replace roofing material.

Consider your risk of high wind (especially in hurricane zones) and hail and make sure the type of material and its mounting hardware can withstand wind and hail hazards without damage. Check your homeowners insurance policy to see if it would cover the cost of replacing a damaged system.

Flexible thin film solar panels blend in between the ridges of metal roofing.

Find a protected location for the inverter(s). If not in the garage or on the north-facing side of the home, add a shade structure for the inverter to enhance its longevity.

Regardless of mounting location, be sure to check fire codes, zoning restrictions, permit requirements, insurance requirements and utility grid connection rules and procedures. Some communities require a certain amount of your roof to remain uncovered by solar panels to ensure firefighters can walk on or cut into a roof safely when venting smoke, flames or extreme heat from a house fire.

Operation and Maintenance

Most home solar systems are designed to operate automatically, with little or no user intervention, other than inspection and cleaning maintenance. You may opt for a monitoring system that allows you to see the system's daily, monthly and annual production and the resulting savings. Some firms may charge a fee for monitoring service.

External issues, such as encroaching shade from growing trees and dirty modules, are common developments that can reduce energy output. Modules that are not periodically cleaned can have an average annual energy loss of five percent in some regions. Areas with sufficient rain tend to have little need for cleaning.

- Trim tree branches and clean the array annually to maintain full solar power production.
- Annually inspect for wires damaged by rodents, bird droppings on modules, weeds sprouting between the module frames, broken cells or other damage.

Internal problems, such as module or cell damage, can reduce system output. Sometimes these problems are easy to spot, but often they are not. Each year, look for cracks in the glass, brown/burn spots on the modules, burnt solder joints on the cell grid and signs of delamination and cell damage. Do NOT attempt to repair such problems yourself, however. Check your warranty terms and get a qualified professional to diagnose and repair a problem.

Most system installers provide an optional monitoring system that enables you to check your system output on your smartphone or computer. Routinely checking your system's output can alert you to problems.

Who Should I Hire To Install My Home Solar System?

If you are buying a home solar system, you choose your installer. If you are leasing a solar system, the third-party company might choose the installer. Either way, it's crucial to choose carefully to ensure a quality installation that will perform properly and not cause damage to your home or the equipment. Note that bids and site assessments typically are free, so don't hesitate to get multiple quotes. Investigate every company you are considering:

Search for local solar firms through the Solar Energy Industries Association (www.seia.org). In addition, explore local solar industry associations and seek recommendations from energy efficiency organizations, your utility company, online referral and review sites and people who have solar systems. Some utility companies and nonprofit organizations with green energy initiatives install rooftop solar systems.

Look for reputable, professional solar suppliers and photovoltaic system installers who have an electrical contractor's license plus documented training and field experience installing residential PV systems. Solar system installers who are certified by the North American Board of Certified Energy Practitioners have passed a rigorous exam and demonstrated a high level of training and experience (www.nabcep.org). Contractors and suppliers who have been in the PV or electrical contracting business a long time may be more likely to be around in the future to back up their products and installation.

Verify the license or credentials of the installer or company you're considering with your state's contractor licensing agency. Some states have licensing requirements specifically for solar equipment installers. Check the Secretary of State's office to see if required reports are up to date.

Find out if there are any judgments or complaints against the company submitted to the licensing board and the Better Business Bureau (BBB) and check the BBB rating of the business. Read online customer reviews for insights and patterns, but keep in mind that extreme and outlying reviews may not be reliable. Check with your state licensing agency or local building official to find out about local regulations and requirements.

Get written proposals from several companies, with clear specifications, costs and estimated annual energy production (and how it was derived). Ask questions and get details in writing. Ask for customer references and talk to them. Never let a vendor rush or pressure you into a quick decision!

Get a Strong Contract

Get a written contract once you select your firm. Make sure it specifies all needed components, services and permits; the payment schedule and terms; a timeline for completion; a statement of workmanship, code compliance, warranties and guarantees; who is responsible for replacement of any components under warranty; and a lien waiver to protect you in the event suppliers have claims against the contractor. If you are leasing a system, get in writing who is responsible to remove and reinstall the system when roof repair or replacement is needed and who should do post-installation roof inspection.

Know the permitting requirements in your locale and make sure the contractor you select completes the permitting process. In some cases, it can be a time-consuming process with a significant cost. Your installer needs to be aware of local building and fire codes to ensure compliance.

Examine Warranties

Whether you buy or lease your solar system, the vendor or leasing company should provide you with a copy of the warranties. **Read all warranties very carefully and ask questions.**

- System warranty terms typically are for 20-25 years at 80 percent or more of original system capacity on solar panels and 5-10 years on inverters, but may have limitations. There may be manufacturer warranties on equipment for varying durations that cover parts and labor or just parts. Find out if the warranty covers the entire system or only selected components. (Note that the actual lifespan of solar panels is likely to exceed the warranty period.)
- The warranty may contain maintenance and repair requirements you (or the leasing company, if applicable) are required to complete.
- Be sure you know who is responsible for fulfilling system warranties (installer, dealer, manufacturer or leasing company) and understand what you need to do to enforce the warranties.

- It's important to have a roof warranty that states what responsibility your installer has for damage to your roof or any other structures during installation, any damages to your home or its contents that result from installation and any crew or public injuries. It should name the types of safety standards the installer should follow during installation.
- If you are leasing a system, make sure the roof warranty covers system removal as well as installation. The lease contract should state who is responsible for removing the system and restoring your roof and home at the end of the lease.
- Check to see if damage from nearby lightning strikes and other electrical surges are covered by your warranty, especially for inverters since their electronics may fail under these stressors.

Ask about the contractor's bonds and other financial arrangements that help ensure warranties are honored. Remember, a warranty never guarantees the company will remain in business. Find out who to contact if there is a problem.

Which Is Better for Me – Buying or Leasing?

Since a home solar power system can cost anywhere from $5,000 to $50,000, how you pay for it is a big deal! There are many considerations to weigh and different costs and benefits of buying versus leasing a home solar system. Local and state incentives and how they apply to a purchase versus leasing should be factored into your decision.

When purchasing a home solar system, you own it. The main expense is upfront, so you may need to get a loan to finance it and you are responsible for its maintenance.

A big advantage of ownership is that once your electric bill savings recoup the initial cost, the remaining electric bill savings are all "profit" (return on your investment). There also may be incentives for purchasing that are not available when leasing.

When leasing a system installed on your home, the leasing company owns it. You have little or no upfront cost and you could start saving some money right from the start – and as long as the energy produced results in utility bill savings that are greater than your monthly lease payment. Since your lease payments continue throughout the lease term (typically 20 years), however, there is no payback point where the purchase cost is recouped and your utility bill savings grow sharply.

Leasing a Home Solar Power System

A solar lease is third-party financing where the company pays the cost of a solar system on your home in exchange for a monthly payment, usually with no money down. Some offer an option to make a small down payment in exchange for lower monthly payments. Some offer prepaid leases that compress the yearly payments into one discounted upfront payment. There may be a minimum credit score requirement to be eligible for a lease. The lease term typically is 20 years.

Since the leasing company owns the solar system, the company gets whatever tax credits, rebates and other incentives are available. These financial benefits and other factors typically enable the company to set your initial monthly payments lower than your initial utility bill savings and still make a profit.

The leasing company monitors and is responsible for maintaining and repairing the solar system. Some provide the homeowner a means to monitor energy production, savings, carbon emissions avoided, etc.

Some leasing companies sell their leases to third-party investment groups, so it's wise to ask who could be the future owner of your solar system. Verify that they have the expertise and capacity to fulfill the maintenance and other responsibilities under the lease agreement.

A lease normally is structured in one of two ways, although the label *solar lease* often is used interchangeably for either type – a ***solar lease (rental) contract*** or a ***power purchase agreement.***

- With a solar lease, you sign a lease contract (similar to leasing a car) and agree to a specified monthly payment schedule for the right to use all the power produced by the system. Your payments are predictable, like rent. If the system produces less than the company predicted, however, you may still be obligated to pay the full rent (making your actual cost per kilowatt-hour higher and reducing your savings), unless the lease provides a production guarantee.
- With a power purchase agreement, you agree to buy the power generated by the system at a set price per kilowatt-hour. You pay only for the electricity produced by the system and used by you. If the system produces less than predicted, you benefit less than expected but your cost per kilowatt-hour for the solar power is the same.

IMPORTANT: With either type of lease, the contract typically includes an **escalation schedule** that defines how the rental amount or price per kilowatt-hour will be increased over time. It usually is in the range of a 2 percent to 4 percent increase each year.

If the power purchase agreement rates or monthly payments rise faster than the actual cost of power from the grid, your cost savings per month decrease over time. In that case, the solar lease payment eventually could cost more than power from the grid. On the other hand, if electric rates from the grid rise more than your contract escalation schedule, your cost-saving benefits increases.

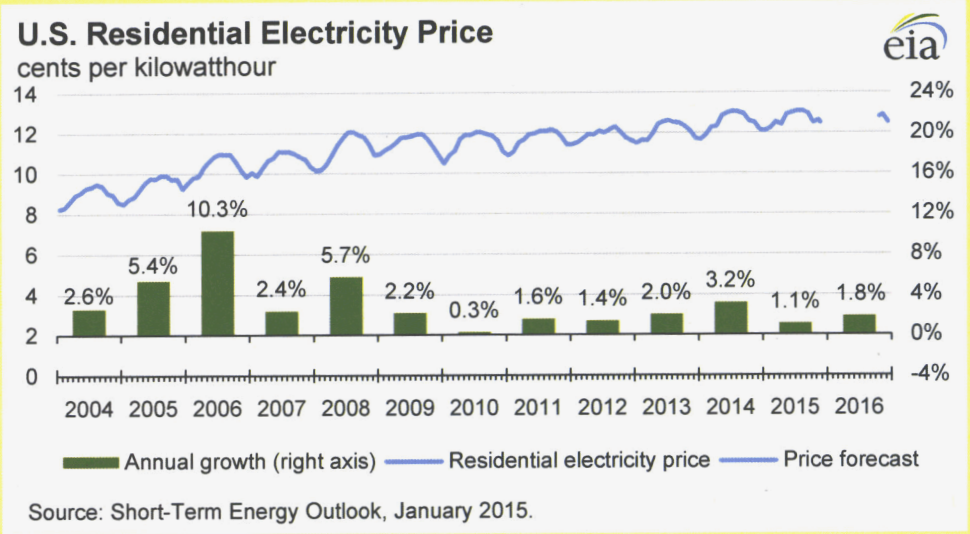
Be Cautious About Predicted Savings

Projections of your total savings over the term of a lease usually are based on a prediction that the cost of electricity from the grid will rise at a rate higher than the contract's escalation rate. If the prediction is wrong, so is the estimated savings. Of course, no one knows the future, so predictions are just that – predictions. A 20-year lease is a long time.

For example, a power purchase agreement may have an annual 3 percent increase in your payment rate but base your predicted savings on a 4.5 percent annual increase in the cost of electricity from the utility for the next 20 years. Assuming a high growth of utility rates inflates the projected savings. If utility rates were to actually rise less than 3 percent per year, your utility bill savings benefit would shrink over time.

Historically, the rise in utility rates has slowed over the past 20 years. Since 2008, the national average increase ranged from 0.3 percent to 3.1 percent per year. Although higher rate increases occurred and are likely in some years and areas (such as the northeastern United States), a low national average growth of electric utility rates is possible due to slower demand growth and lower fuel costs.

Ask for the assumptions used to predict savings and verify how the solar power system's expected production was determined. Ask your utility company how rates have changed in the past few years and compare to the power purchase agreement's escalation rate.



Source: U.S. Energy Information Administration – www.eia.gov.

Additional Solar Lease Contract Provisions

A right to rescind the contract (the right to change your mind and back out after signing) within a specific number of days after signing may be required in some states or specified in some leases. For example, in Louisiana, state law requires a three-day right to rescind contracts resulting from door-to-door sales. Check your state's applicable law.

> **Consumer Alert: Before you sign anything, read it. There have been cases of consumers signing contracts when they thought they were only signing an acknowledgment of receiving information.**

Operation and maintenance requirements assigned to the homeowner in a lease agreement may include tree trimming, panel cleaning, no modifications to your home that result in shading, prevention and correction of any condition that can inhibit system operation, a functioning Internet connection and visual inspection and notification to leasing company of any system damage or concerns.

In the event of system malfunction, faulty installation or damage to your home, your contract should require timely repair and state your rights when that doesn't happen. It also should state whether or not there will be any suspension or reduction of monthly payments when your system is not operating.

> **Consumer Alert: Common complaints include damage to roofs, holes in walls or soffits, sloppy hole repair, exposed conduit or wires, poorly secured or fallen solar panels, unsafe work practices and delayed installation or repairs.**

Lease renewal and purchase provisions may allow you to buy the system or renew the lease for a specific number of years at the end of the lease term. The contract may specify a minimum price or "fair market value," whichever is higher. Early purchase typically is allowed but may be restricted to certain times or conditions.

Consumer Alert: Find out how the company will determine fair market value. With continuing advancements in solar energy technologies, it can be difficult to predict the future market value of a solar system.

Termination provisions should list circumstances when and how you or the leasing company can end the lease. It should describe what is required if you sell your home, want to buy the system, have a catastrophic property loss or die. Look for provisions about your rights and remedies in the event the leasing company ends the lease, sells the lease, goes out of business or engages in deceptive practices. The lease also should detail what will happen if you default on the lease or make late payments.

Consumer Alert: If the lease is sold to a third-party investor without notifying you, you would be unaware of who to contact for repairs and other needs.

If you sell your home with a solar lease:

- The homebuyer may need to meet the solar leasing company's credit requirements and be willing to assume the lease agreement and payments.
- You, the home seller, may be able to move the solar lease panels to your new home (if located within same utility district) at your expense.
- You might pay off the lease and transfer the solar rights to your homebuyer.

Some potential homebuyers may be hesitant to assume a lease on a system that is not as efficient as newer technology. Ask the leasing company if they offer an option to upgrade your solar system when there are advances in efficiency during the term of the lease.

In the event of homeowner default, leasing contracts may include remedies such as requiring you to return the solar system at your expense, filing for court action to enforce performance of the lease contract and seeking reasonable compensation. The company also may submit a negative credit report to credit reporting agencies.

Most solar leases state they will not take a lien on your home since the company owns only the leased equipment. It may still file a Uniform Commercial Code instrument, if needed, however, to give public notice that it has or may have an interest in the personal property of a debtor and a right to take possession and sell certain assets for repayment of the debt.

In the event of leasing company default, your rights, remedies or limitations may include right to judge or jury trial, class action participation, attorney general action, arbitration or trial allowed only in a certain jurisdiction, filing or attorney fees, limitations on damages or waivers of certain rights. You may wish to consult a legal adviser before signing a contract to ensure adequate protections.

Purchasing a Home Solar Power System

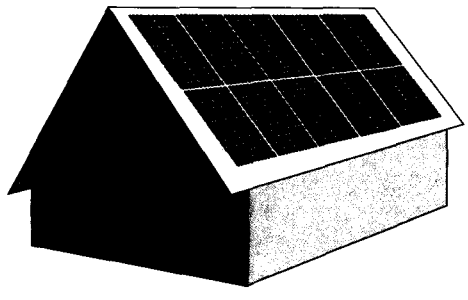
If you purchase a solar energy system, you can take advantage of the available incentives and programs to reduce the purchase cost (see Find Incentives section). Be sure to examine the limits and details of incentives before you select your system. It can be helpful to consult your tax adviser – to determine your capacity to use tax credits, as well as whether or not you will owe taxes from receiving incentives.

If you plan to finance the purchase, many states offer low-rate and zero-down-payment incentive loans that can apply to home solar purchases. Check www.dsireusa.org.

Some local governments may offer **PACE** (Property Assessed Clean Energy) financing programs that make loans to consumers for renewable energy or efficiency upgrades, which are repaid through an assessment on property taxes. Concerns about how PACE impacts home mortgages (deemed nonconforming to mortgage underwriting guidelines) is an issue that stalled many PACE programs, but some cities and states have re-established residential PACE programs with disclosures, reserve funds and other measures to address such concerns.

Another financing option is a home equity loan or second mortgage. Such loans obligate your home as collateral, but they have lower interest rates than other types of financing, and the interest may be tax deductible, further reducing your finance cost. Federal Housing Agency, or FHA; Veterans Affairs, or VA; U.S. Department of Agriculture, or USDA; and other lending agencies may offer specialized loan programs with favorable terms for renewable energy.

Consumer Alert: Before you sign a loan agreement to purchase a grid-tied photovoltaic system, be sure to obtain an interconnection agreement with your utility company. Otherwise, you could wind up obligated to make loan payments before your system is approved for interconnection by the electric utility.



Sample Scenarios

These sample scenarios from two states with different incentives illustrate how you could figure and weigh the costs and benefits of buying a specific home solar energy system.

Buying a Home Solar Power System

These factors (1-5) are the same for both situations:

1. The home electricity use averages about **1,000 kilowatt-hours (kwh) per month**.
2. The local utility's rate for electricity **is 10 cents per kwh**, so the average **monthly bill is $100,** and the annual electricity cost is $1,200.
3. Both people plan to buy a 4 kilowatt solar system that will cost **$15,000 installed** (at $3.75 per watt).
4. The system for each household is expected to **produce about 500 kwh per month**, which is half of the household's average power use.
5. Both are eligible for net metering, so the average monthly electric bills are expected to be cut in half – which translates to a reduction of **$50 per month or $600 per year**.

Joe's Situation

6. Joe plans to use the **federal tax credit of 30 percent,** which **lowers his net purchase cost to $10,500** ($15,000 x 0.30 = $4,500; then $15,000 - 4,500 = $10,500). There are no additional tax credits in his state.
7. For Joe's net purchase cost of $10,500 and utility bill savings of $600 per year, it would take **17.5 years to recover his investment ($10,500 / $600 = 17.5).** After that, he benefits $600 per year for the remaining useful life of the system (typically three to eight more years).

   NOTE: If the electric utility rate rises, Joe's annual savings rise, too, and the payback period would be shorter. For example, if the utility rate increased to 30 cents in 20 years, he saves $1,800 per year by then, and his payback period could be less than nine years.
8. If Joe borrows $10,000 at 5 percent interest for a 20-year term, his monthly loan payments would be $66. That's **$16 more than his initial monthly utility bill savings**.

   At any point where the utility rate rises to 13.2 cents per kilowatt-hour, Joe's solar power system with net metering would offset the entire $66 monthly loan payment. If the utility rate increased to 30 cents in 20 years, he would save $84 per month (half of a $300 utility cost or $150 - $66 = $84).

Jean's Situation

6. Jean's state provides a **50 percent state tax credit** (which means a return for her of $7,500). In addition, she will apply the **30 percent federal tax credit, reducing her net purchase cost to $3,000** ($15,000 x 0.8 = $12,000, then $15,000 - 12,000 = $3,000).
7. For Jean's net purchase cost of $3,000, it would take only **five years to recover her investment** ($3000 / $600 = 5) and for her to then begin to profit. After that, she benefits $600 per year for the remaining useful life of system (typically 15-20 more years).

   If the utility rate increased to 30 cents in 20 years, Jean would save $1,800 per year by then, meaning her payback period might be shorter and her savings greater.
8. If Jean borrows $3,000 at 5 percent for a 20-year term, her monthly loan payments would be $20. That nets her an **initial monthly savings of $30 per month.** If the utility rate increased to 30 cents over time, her monthly savings would be $117.

Note: In reality, solar power production, savings and payback from Joe's and Jean's solar systems would vary. Maintenance expenses may be incurred, and production varies with weather and shade changes. Electricity rates could rise more than expected, which would increase the annual savings from the solar power produced and shorten the payback period. Conversely, if utility electric rates fall or expenses rise, the reverse happens (savings would be less and the payback period lengthened).

Comparing Buying Versus Leasing

When weighing buying versus leasing, be sure you compare "apples with apples," so to speak, meaning that you compare the same type and size system and thus the same solar power output in both financial scenarios. Consider the following:

- Figure out the effects of all tax credits and other incentives on your purchase cost or how much they would reduce your needed loan size. Determine whether any of the available incentives can still benefit you if you lease (such as property tax exemptions).
- Compare the monthly cost of getting a loan versus leasing the system for the same time span. A loan will identify the interest rate and monthly payment so you easily can compare. Factor in the effect of your tax deduction of the interest portion of a home equity loan, if applicable.
- A purchased solar system tends to be an asset that increases the property value and shortens time on the resale market. The added value also could be tapped as higher home equity to borrow against.
- If you might sell your home in the future, a leased system may be considered a liability the new owners would have to assume and may complicate the closing process.
- During the day, many home solar systems produce more electricity than the home is using. If that's likely, the availability of net metering could have a considerable efffect on the savings you expect.
- In leasing, you may expect your lease payments to be less than the cost of electricity from the grid – both initially and throughout the term of the lease. If the contract includes annual rate or payment increases, determine projected monthly payments throughout the full lease term.
- In financing a purchase, you may be willing to accept a monthly payment that initially is higher than expected utility bill savings because your loan payments will not increase over time, so your bill savings will grow as utility rates rise. Then, once the loan is repaid, monthly loan payments stop.
- Check your local tax laws or consult your tax adviser to find out if owned and leased solar systems are treated differently.

The Bottom Line...

Energy efficiency and conservation trumps all and should be your first priority in green living and lowering home energy costs. When you want to do more, use this guide and the attached list of Questions to Ask to help you make a good investment and choice for going solar at your home.

Resources

For more information on solar power and energy efficiency, visit these sources:

American Solar Energy Society – www.ases.org

Building America Solution Center (U.S. Department of Energy) – https://basc.pnnl.gov

Database of State Incentives for Renewables and Efficiency – www.dsireusa.org

Energy Star (U.S. Environmental Protection Agency) – www.energystar.gov

eXtension Learning Network's Home Energy Section – www.extension.org/home_energy

Florida Solar Energy Center -- www.fsec.ucf.edu

National Renewable Energy Laboratory – www.nrel.gov

North American Board of Certified Energy Practitioners – www.nabcep.org

PVWatts® Calculator –http://pvwatts.nrel.gov

Solar Energy Industries Association – www.seia.org

U.S. Department of Energy – www.energy.gov or www.solar.energy.gov

U.S. Department of Energy / Energy Savers – www.energysavers.gov

U.S. Energy Information Administration – www.eia.gov

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Appendix 1
Solar Leasing Versus Ownership Calculators

It can be helpful to search online for *solar leasing versus ownership calculator* websites or apps. Look for and try a few that factor in and allow you to adjust assumptions and enter your information on loan terms to purchase versus leasing terms (including escalation rate) to provide a financial comparison. Be sure you compare similar type and size systems! The calculator should include the following input factors:

Solar Power Output:

_____ Kilowatt PV system size (kilowatt power capacity)

_____ Kilowatt-hour annual estimated solar power production (calculator may derive from your location and system size)

_____ Percentage of annual output degradation (expected decrease in production per year – typically 0.5 percent)

Electricity Rates:

$_____ Per kilowatt-hour electric utility retail rate (what you pay for electricity from the utility)

$_____ Per kilowatt-hour solar power purchase rate (rate utility credits or pays for surplus solar power)

Note: If net metering applies, solar power purchase rate is same as utility retail rate.

Solar Power System Cost and Incentives:

$_____PV system installed cost (equipment and installation; may be derived from an average cost per watt)

$_____Federal tax credit (30 percent of system cost; applies to you if you buy or to leasing firm if you lease)

$_____State tax credit if you buy system (your state's percentage credit of system cost, subject to limits)

$_____State tax credit to leasing company (your state's percentage credit of system cost, subject to limits)

Note: Calculator may assume state tax credit applies equally to homeowner or leasing company. Separate calculations are needed if the state credit is different.)

$_____Rebates or other system cost reductions

Loan Terms to Purchase the System

$_____ down payment

_____ % interest rate

_____ years (to pay off loan)

Solar Leasing Terms

$_____ Down payment

_____ Years of lease term (length of lease agreement)

$_____ Initial monthly lease payment (for solar lease; or for power purchase agreement, it may be calculated from power purchase agreement rate per kilowatt-hour times monthly solar power production)

_____ Percentage of lease price escalation (annual increase of lease payment or power purchase agreement rate in lease agreement)

_____ Percentage or utility price inflation (predicted average annual increase in your utility company's electricity rate)

$_____ Purchase price at end of lease (optional)

Other Economic Factors (optional financial calculations to determine investment value over time)

_____ Percentage of inflation rate (projected overall inflation rate for estimating long-term investment value)

_____ Percentage of discount rate (an economic measure of how much future dollars are worth today

Appendix 2: Questions to Ask

When Considering a Solar Power System for Your Home

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1. What **energy efficient improvements** should be made to my home before investing in a solar energy system?
2. What renewable energy **alternatives** are available such as community solar or utility renewable energy programs?
3. How much electricity did my home use last year? How much is it likely to use in the next year (considering energy efficiency and household changes)? What is my **average kilowatt-hour use per month** (estimate for next year)?
4. What is the current rate I pay for electricity (cents per kilowatt-hour) from my utility company? What is my **average monthly electricity cost** (estimate for next year)?
5. What is the history of electricity price changes for my utility company? What **annual electricity inflation rate** trend is predicted by my utility company, state regulators, U.S. Department of Energy, local university or other reliable source?
6. Would my home be eligible for **net metering**? If so, are there system size limits to qualify? Could it change or expire for me in the future? How does the program treat energy I produce in excess of my use? If I'm not eligible, what is the rate (cents per kilowatt-hour) the utility will credit or pay for surplus power I generate? Is the rate higher at peak demand times (usually late afternoon)?
7. How much **solar power (kilowatt-hours per month)** would I like to generate? Should my home solar PV system be sized to avoid producing more power than I use (surplus)?
8. What **incentive tax credits, exclusions and rebates** are available that would reduce the cost of buying a home PV system? What are their limits and requirements? When does each expire?
9. What is my area's **solar resource** (average amount of sunshine per day)?
10. Does my community have any restrictions on placing solar panels? How much **unshaded roof area** facing south, southwest or southeast is available? How much faces west? What is the roof slope?
11. Should my **roofing** be replaced before installing a solar system? Will installing a PV system void my roofing warranty?
12. Would I prefer a thin film system that blends into my roofing or a crystalline **type of photovoltaic technology** for higher efficiency in less area? Can it withstand hail and my area's wind risk? What is the expected service life? What are common problems with each type of system? What is the reputation of the manufacturer?
13. Do I need **batteries** for an off-grid or hybrid backup power system? What are the associated costs, hazards, space requirements, maintenance and service life of the batteries and other components?
14. Does the system use one **central inverter or micro-inverters** on each module? What is the expected life and what will it cost to replace it?
15. What **monitoring systems** are available? What information do they provide? What do they require and what do they cost?
16. What **solar power capacity (kilowatts)** will fit on my available roof area (of the type I want)? How much electricity (kilowatt-hours) is it expected to generate **(energy output)** in the first year? How was that determined? What is the expected annual **degradation rate** (reduction in electricity produced)?
17. What is the **total installed cost** of the PV systems I'm considering? What is the typical cost per watt in my area? How much will the available tax credits, exclusions and rebate **solar incentives** reduce my cost?
18. Are there any low cost **solar loan programs** available to me? If not, do I qualify for a VA, FHA, USDA or HUD home improvement loan? Or could I qualify for a home equity or second mortgage loan? What are the available interest rates, down payment requirements, closing costs, other terms and tax advantages?
19. What is the **monthly payment to finance** the net purchase cost (after incentives), with and without a down payment? How does that compare to predicted monthly utility bill savings – both initially and as electric rates rise?
20. How many years will it take to recoup my net purchase cost **(payback period)**? What will my annual utility bill savings be after payback? What is the equipment's expected service life? What is my estimated **total return on investment**? (Use an online calculator.) Does the return on investment factor in general inflation?

21. How will a rooftop solar system affect my home's **market value**? Do I need to inform my **homeowners insurance** company? How will a solar system or batteries (off-grid) affect my premiums? Will my **property taxes** change?
22. Will the firm providing a quote on the system install it or hire installers? What are the **qualifications, certifications and licenses of the installers?** Are they bonded and have liability and workmen's compensation insurance? How long have they been installing PV systems on homes? How long have they been in business?
23. Have any **complaints** been filed against the vendor, manufacturer or installer with the state licensing board, consumer protection agency or the Better Business Bureau? Are their customers satisfied with their work quality and follow-up service?
24. What does the **warranty** cover (solar panels, inverter, mounting rack, labor, etc.) and how long? Who is responsible to make warranty repairs? What maintenance does the warranty require?
25. Does the **contract state in detail** the system components, timeline for completion, payment schedule, a lien waiver and who is responsible for any damages, injuries and permitting? What are my rights if my roof, home or contents are damaged, the installation is poor or someone is hurt by the installation? Who will be responsible for repairs?

Additional Questions to Ask

When Considering a Solar Lease

When considering a solar lease, first ask the previous questions and then ask the following questions to help you compare the initial and long-term costs and benefits of buying versus leasing for your home and needs.

26. Can I lease the **solar system type, capacity and installer** of my choice? If the leasing company makes the choice, why is its selected system recommended?
27. What is the **lease term** (years)? What happens at the end of the lease? Is it renewable? If I don't renew, who is responsible for removing the PV system and restoring my home?
28. Would I rather pay a set amount each month (rental-type **solar lease**) or pay only for the solar power my home uses (**power purchase agreement, or PPA**)? Which method would likely result in a lower total cost over time?
29. What **incentives** will the leasing company receive? With a solar lease, am I eligible for any incentives such as property tax exclusions or others that the leasing company cannot use?
30. What will be **my monthly payment or power purchase agreement rate** (cents per kilowatt-hour) for the first year? How does that compare to my electric utility rate or average monthly bill? How does it compare to a loan payment amount (Question 19)?
31. What is the lease **annual escalation rate** (percentage the payment or power purchase agreement rate will rise each year)? What will my payment or rate become each year of the lease (payment escalation schedule)? When will it exceed a loan payment amount?
32. How does the lease escalation rate compare to my **utility company's historical and predicted inflation rate** (Question 5)? What are the basis and assumptions of the leasing company's projected utility inflation rate and **total predicted savings** over the entire lease term?
33. Do I have a legal **right to rescind** (back out of) the lease after signing it? If so, how many days is the right in effect?
34. Could my lease be **sold to another company** or investor? Who could be the future owner of my system? Do they have the expertise and capacity to fulfill all obligations under the lease agreement?
35. What are **my responsibilities in maintaining** and operating the solar system? What are the leasing company's responsibilities? What do I do if the system isn't working or is damaged? Will my monthly lease payment be reduced or suspended when the system is not operating?
36. When my **roofing needs replacement**, who is responsible for removing and reinstalling the solar panels?
37. Under what circumstances can the lease be **terminated** (ended) by me or the leasing company? What can I do if the company doesn't maintain the system, goes out of business or uses illegal or deceptive practices?
38. What happens if I can't make payments and **default** on the lease? What if my payment is late?
39. If I want to **sell my home**, what does the lease require from the buyer and from me? What if the buyer doesn't want to assume the lease? How will a leased solar system affect my home's marketability and value in my location?
40. If I ever want to buy the leased system, how is the **fair market value** determined? Can I buy it at any time?

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Exhibit 9

"Solar rooftop installer assumes soaring utility rates in cost-saving claims," Energy Daily (February 9, 2015)

February 9, 2015

Solar rooftop installer assumes soaring utility rates in cost-saving claims

BY ERIC LINDEMAN

Amid a raging battle between utilities and solar leasing companies over the benefits of rooftop arrays to homeowners, questions are being raised about marketing materials issued by SolarCity, a leading rooftop installer, that appear to calculate potential cost savings to homeowners from its systems by projecting long-term increases in utility electric rates that are much higher than the industry's historical rate hikes—or federal assessments of future rate hikes.

SolarCity and other rooftop installers strongly deny that they are not being fully transparent with customers about potential savings from 20-year leases of home arrays as compared to paying utility rates.

However, *IHS The Energy Daily* has obtained SolarCity marketing material that estimates utility rates will increase at a far faster rate than has been the case for investor-owned utilities in recent years.

The SolarCity marketing material says utilities are in line for "expected annual [rate] increases" of 4.8 percent. The 4.8 percent figure is listed under the heading "UTILITY-Your cost without solar," without explaining where the number came from or how it was calculated.

However, the Edison Electric Institute (EEI), the association of investor-owned utilities (IOU), says data from the Energy Information Administration (EIA) shows that between 1993 and 2013, the average annual rate increase for the whole electric utility industry was only 1.9 percent, while IOUs averaged 1.5 percent annual rate increases over the same period.

EEI also said that looking forward 20 years¬—the average lease term for a rooftop solar system—EIA projects total average retail electricity prices to increase 2.1 percent per year between 2013 and 2033.

SolarCity declined to explain the data and calculations by which it projected the 4.8 percent "expected" annual utility increase.

However, company spokesman Jonathan Bass told *IHS The Energy Daily*: "SolarCity provides its customers a greater level of transparency into future pricing than any utility in America."

Bass said many utilities will not tell their customers what rates they will pay next year, while SolarCity puts its long-term rates down on paper.

"[W]e estimate future utility rate increases based on recently announced rate cases, externally developed forecasts of the key variables that influence rates, including fuel prices, general inflation, and the cost to comply with environmental mandates such as renewable portfolio standards and carbon dioxide emission reductions," he said.

"To be clear, customers have varying views on future utility prices and can evaluate savings using alternative values, but SolarCity places utility-specific limitations on the rate increase assumptions. In some utility districts, the maximum assumption we would allow would be 4.8 percent.

We periodically review these values and update this methodology to reflect new and locally-specific information to determine the appropriate maximum increase assumption that can be used in a utility district."

But missing from among the variables that SolarCity's methodology evaluates is that utility rates fluctuate year to year, and under a multi-year rate case, might be very high one year and increase very little or actually decline in another year.

Utilities, many of whom have been stung by the loss of power sales to rooftop solar, also say rooftop installers are less than transparent with customers about who gets federal tax benefits from leased solar arrays. These critics note that since rooftop systems are owned by the leasing company, federal and state tax benefits and valuable renewable energy certificates go to the leasing company, not the homeowner—a fact not always clearly presented in rooftop marketing materials.

The initial attractiveness of rooftop solar leases is that they have no up-front installation costs for the homeowner, who instead agrees to buy the electricity generated by the rooftop panels under a long-term power purchase agreement (PPA) with the solar leasing company.

SolarCity's PPA rate, as shown on the company's website, is 19.669 cents per kilowatt-hour (kWh), and the agreement includes a promise that rate "will never increase by more than 2.9 percent per year." Although the choice of that percentage increase is never explained, it is more than the EIA forecasted average utility increase through 2033.

Projected increases in U.S. utility residential electricity rates, on average, also are significantly lower than SolarCity's rate. Utility rates are projected to average 12.50 cents per kWh for 2014, according to EIA, and are expected to rise to 12.63 cents per kWh in 2015 and 12.86 cents in 2016.

With such high rates, SolarCity is limited to operating in states with especially high electricity rates.

"SolarCity offers service in the areas where we can provide solar electricity at a discount to utility rates, and those areas have historically seen higher retail electricity rate increases than other parts of the country," Bass said.

Those include California—SolarCity's largest market—and the Northeast, where states like Massachusetts and Connecticut have also experienced large increases in electricity costs in recent years.

The marketing practices of solar installers have drawn questions in recent months from some lawmakers who have asked federal consumer protection agencies to look into the matter.

Responding to requests by 16 members of Congress, two federal consumer protection agencies last month agreed to examine the lawmakers' concerns that solar leasing companies may be using deceptive marketing practices.

While stopping well short of promising an investigation, the heads of the Federal Trade Commission (FTC) and the Consumer Financial Protection Bureau (CFPB) told the lawmakers in letters they will cooperate with state enforcement agencies to ensure that solar leasing companies are meeting federal requirements to fully disclose lease terms and substantiate energy savings claims, among other issues.

In a January 12 letter to four House Democrats who had asked for an investigation of solar leasing companies in November, CFPB Director Richard Cordray said his agency is "currently studying a number of overlapping issues that may implicate the leasing of rooftop solar panels, including financing, market conditions, and industry practices that may affect consumers."

In a January 13 response to 12 House Republicans who wrote to her agency in December, FTC Chair Edith Ramirez noted the lawmakers' concerns that many homeowners were not fully aware of the terms of their solar leases and may suffer substantial financial hardship due to undisclosed or poorly disclosed financial obligations.

Ramirez said the FTC works closely with state consumer protection agencies, most of which are members of Consumer Sentinel, a FTC database that includes millions of consumer complaints filed with states. She said the database to date includes about 30 complaints that "relate to potentially fraudulent claims made for solar leases."

Exhibit 10

Customer Complaint Summaries

Samples of Complaints and Concerns Regarding Rooftop Solar

Customer Service Notations From Actual Customer Calls Between August 2014 and January 2015

Savings promise

- Concerned about high bill fees, she was misled by solar company and stated she would follow up with them
- Customer states was told by solar installer that APS changes rates 6-7 times a year.
- Customer concerned that the buyback rate is much lower than was quoted to her by solar company at install. She was not aware that the rate can change and did change.
- Customer states was advised by solar company that having so many panels would eliminate APS billing--received his first bill from aps and was billed apprx $60.00 for net need from aps states he is now paying more than he would have had he not been on solar.
- Spoke with customer advised ms that incentive issued as one time incentive--ms states she was advised by solar installer that incentive issued every year from aps to her as customer.
- Customer called in regarding statement. Cust adv that solar company told him his bill would be $5.00 plus tax once on solar.
- Customer was advised by solar installer would have average bill of $35; customer average bill in last 10 months = 77.49, over last 3 months for summer bills = $184.17
- Customer wanted to know why she is not seeing as much savings as she expected since having solar panels. Customer was told to see if she is on the best rate plan. "They say that it's [solar panels] supposed to be 70% off your electric bill, but I just don't see it. "
- Customer upset that [Solar Company] provided her a projected savings amount of 31% and based on usage receiving only 15% reduction. Customer has [Solar Company] on other phone (can her their conversation)
- Customer calling in to change their rate plan and discuss the amount of the bill. Customer was advised by [Solar Company] that if they change their rate to the standard plan they should see a $35 average bill from APS. Customer does not fully understand the rates and he is currently paying more than he expected when switching to Solar. "The whole reason we went solar was to lower our bill...."

- "What I'm being told here is, on the Standard rate plan, I should expect see, on average from APS, somewhere around $35 per month", "Instead of me saving around $100 per month...my bill went up $130 a month..."
- Customer looking into getting solar so she was calling to ask more about it. Solar company made several claims that she wanted to validate before signing the contract. The installer told customer she should add a few more energy savings tools to her home in order to realize savings with solar panels; fans in attic and shade screens. The salesman advised the customer that APS increases their rate about 6% each year. The solar salesman told the customer, that in his experience, customers that had a $250 average APS bill don't go over $30 a month once solar panels are activated. For customers that had an average APS bill of $300 a month, the highest bill he saw after solar panels were activated was $60 per month.
- Customer was advised by [Solar Company] to cancel APS all together and go completely solar. "[Solar Company] wanted me to cancel completely form APS and go with them...."
- [Solar Company] advised customer that APS charges solar customers an extra fee in December

Application promise/concerns

- Customer called regarding her APS interconnection. I have no application. Customer states she signed an APS form for [Solar Company]. Provided aps.com/solarforms. Recommended change of service plan at solar commissioning.
- Customer called regarding his interconnection app. adv app started on 12/21/2014. Cust called in on 12/11 and was adv of all program steps and adv to start the app. He states he contacted the installer the same day who told him NOT to apply that they will take care of it. Panels installed end of Oct 2014.
- [Name omitted] with [Solar Company] called regarding Customer Application. She stated there was a pop up requiring a Land Lord tenant rider. After discussion she stated she was filling out the interconnection application FOR the customer. Adv that the customer is supposed to fill this out and not solar installer.
- Customer called regarding his interconnection application. He advises system installed 10/31/2014. App started 11/11/14. Cust stated that the solar company told them that they are waiting on APS.
- Customer called regarding his solar application. Adv we do not have an application online for him. Encourage customer to start application process ASAP. Customer

indicated that [Solar Company] will submit application. Stated he has a liaison who will submit apps for him. This customer believed we had the application started because construction had been out regarding shed at house.

- Customer called has had solar on rooftop for couple of months. Advised Mr. app only received 12/3, but customer was approved on 12/18. Explained application process email communications during review period.
- Customer called in regarding his interconnection. Stated panels installed Early September installation and app process started on 10/26/2014. Customer had approximately 8 weeks from the application start to finish. Cust says he did not file the application that installer took care of everything.
- Panels installed on 12/6/2014 and customer has not started application for interconnection and refused to start one. He stated his installer told him they would handle application. I advised the only way to do so is for them to use his user name and password to start process. Did not provide timelines to cust. Cust quoted a 5 week timeline for interconnect per installer. Customer will call installer.
- Installer advised her they would submit the application on her behalf and they did not do it, her panels were already installed.
- Installer [Solar Company] didn't submit paper work and checks before they installed the system.
- Customers called in because his solar panels were installed on 7/28/2014. I advised that his application was submitted on 9/4/2014. His request to interconnect is stuck in step 3 of 4 for an installer check list we requested 10/8/14. Installer stated that we requested new application and that is why the process is stalled. Customer did not indicate that he initiated the application via aps.com himself.
- Customer called to find out when her meter will be set. Adv interconnect app started on 12/2/2014. Customer states she did not initiate app. Verified email addr. Customer stated that the solar company told her they take care of application and they do not start that application until the clearance is received by city.
- Customer advised by installer [Solar Company] that "Now it's up to APS to complete application", Customer was advised on 11/19 of aps.com/solarforms but as of yet has not started process because he spoke with installer whom advised they would submit application.
- Customer upset about length to have bi-directional meter set. Had solar installed on 9/11/2014. Did advise customer application recd 10/30/14. Mr. wanted to have concern indicated.

Rates/misinformation

- Customer states she got a letter from solar company indicating that she is on the combined advantage service plan and it's designed to charge her $75.00 in hook up charges. Customer read from letter. She had placed a call to the installer regarding her billing. She has already been changed to standard rate plan.
- Customer wanted to know why her bill was so high. [Solar Company] advised her that she should not have to pay the LFCR-DG charge ("Grandfathered in"). Advised that the application was not submitted in time to get grandfathered in to prevent the LFCR-DG charge. Customer was upset that the installer did not submit the application in time. Customer stated, "I'm going to call [Solar Company] and flip out on them"
- Customer called to ask about a surcharge for being a solar customer. Advised customer he was on the Combined Advantage rate and that would not save him since he is now a Solar Customer. Solar Company told him if he applied before the end of 2013, then he would not have to pay the LFCR-DG. Customer was advised that we didn't get his application submitted until June 2014.