# Solar Leasing for Residential Photovoltaic Systems





## Introduction

In the past year, the residential solar lease has received significant attention in the solar marketplace, primarily for its ability to leverage two key commercial tax credits for the individual homeowner. However, on January 1, 2009, the $2,000 cap on the residential investment tax credit (ITC) was lifted. As a result, the expansion of the solar lease model across the United States may be slower than anticipated. Homeowners may revisit the comparison between the solar lease and home-equity financing in light of the change to the ITC.

Market conditions have changed, however, and the solar lease provides some distinct advantages. Given the current financial crisis and the decline in home values, qualifying for a home equity loan is more difficult. Also, in response to the removal of the residential ITC cap, state and utility incentive programs have begun to lower their rebates for small photovoltaic systems (<10 kW). These two factors will reduce the negative impact of the ITC revision on the attractiveness of the solar lease model. In addition, solar lease programs require little or no up-front cash to participate as well as the possibility of passing on the operations and maintenance (O&M) responsibilities to a qualified installer. As a result, the solar lease still may be an attractive option for many homeowners who want to install a residential PV system and begin generating solar electricity.

This publication examines the solar lease option for residential PV systems and describes two solar lease programs already in place.

## How it Works

For several years, leases have been used to finance capital equipment in the commercial sector as well as personal automobiles. They are now being introduced to the residential PV market in a variety of locations across the United States. While many forms of leasing exist, the concept is straightforward. Instead of purchasing a PV system, a homeowner enters into a contract with a lessor (the owner) of a PV system and agrees to make monthly lease payments over a set period of time while consuming the electricity generated. If the local utility has a net-metering policy, the homeowner will receive credit for any excess electricity sent back to the grid.

In an ideal situation,[1] this combination of a monthly lease payment and a lower monthly utility bill will be less than the utility bills that the homeowner had been paying prior to installing the system. At the end of the lease period, a purchase option may give the homeowner the opportunity to buy the PV system. Alternatively, the homeowner may be able to extend the lease agreement or have the system removed from the roof. The lease also may be enhanced if the lessor agrees to provide ongoing O&M services, including the cost of replacing the system's inverter. This is an attractive feature for homeowners who want to benefit from solar power but who are intimidated by the perceived maintenance aspects of owning a PV system.

[1] Although the high up-front cost of PV means this ideal is only achieved in states with some type of incentive (e.g. up-front, performance based), or solar mandate to support PV.

## Tax Benefits

Until recently, the federal tax code overwhelmingly favored commercial (over residential) ownership of PV systems. Through December 31, 2008, the homeowner's investment tax credit (ITC) of 30% was capped at $2,000; whereas the commercial ITC had no upper limit. For all but the smallest PV systems, this created a significant advantage for commercially owned systems. However, the Emergency Economic Stabilization Act of 2008 removed the $2,000 residential cap as of January 1, 2009 (House of Representatives 2008), and the ITC advantage for commercially owned PV systems no longer exists.

A commercial PV owner does have the additional tax benefit of depreciating the cost of the PV system – a homeowner does not. The commercial entity can depreciate the installed cost of the system minus 50% of the business investment tax credit (ITC) over the first five years of ownership (SEIA 2008) using the modified accelerated cost recovery system (MACRS) (DSIRE 2008). According to a report by Lawrence Berkeley National Laboratory, the tax benefit of this depreciation is equivalent to 26% of the installed cost of the system, 12% of which comes from the ability to accelerate it over the five-year period (Bolinger 2009).

However, if a homeowner buys a PV system using a home-equity loan instead of leasing it, the interest on this loan may be tax-deductible (a tax professional can make this determination). If available, this potential tax savings should be factored in to the analysis when the "buy versus lease" decision is being made. The challenge is that credit availability under the home-equity loan model has been severely curtailed as a result of the ongoing financial crisis. Banks have tightened credit requirements, and declining home values have eliminated a substantial portion of equity accrued during the past three to five years. At the same time, the financial crisis also may impact the funding available for residential solar lease programs, which could impact how rapidly these initiatives can be expanded. Nonetheless, this analysis assumes both options are available to the homeowner.

## Examples of Solar Lease Programs

### SolarCity

SolarCity, based in Foster City, California, is actively marketing its solar lease program in California, Oregon, and Arizona (SolarCity 2008). Leases constitute the majority of the company's residential revenues. The financial institution, Morgan Stanley, is the tax equity investor in these solar projects and claims the ITC and depreciation benefits. The company is considering other expansion opportunities across the United States for 2009 (see the SolarCity Web site at www.solarcity.com for more information).

SolarCity typically offers a variety of lease structures, including zero down-payment options; although the higher the down payment, the lower the monthly lease payments. In addition to the cost of the system, the lease payment covers the cost of monitoring, maintenance, and repair, including an inverter replacement, if necessary. SolarCity guarantees a minimum level of electricity output (in kilowatt hours – kWh) of the system as well.

According to company representatives, SolarCity concentrates on areas where continually high electricity rates and attractive incentives allow most customers to achieve savings from the outset of the lease, while still providing a reasonable rate of return to its financiers. Pricing and deal structure vary based on local market conditions – for example, a 3.2 kW PV system in Northern California may cost the homeowner $83/month but reduce the utility bill by $125/month, resulting in a net savings of $42/month. In Arizona, where utility rebates are more substantial but local utility rates are lower, a customer might pay only $43/month for the same 3.2 kW system, reducing utility bills by $53/month, resulting in a net savings of $10/month. SolarCity also varies the length of the lease and annual rate at which the lease payment increases (the escalation rate) as local conditions dictate – in California and Arizona, leases usually run for 15 years with rate increases of 3.5% per year; in Oregon, leases run for 10 years and have a 0% escalator.

At the end of the lease term, the homeowner can renew the lease, purchase the system at its fair market value, or request that the system be removed at no cost. If the homeowner moves within the lease period, there are three options. The homeowner can:

- buy out the lease and include the system as part of the home being sold,
- move the system to the new home (at the homeowner's expense) if it is within the same utility district, or
- transfer the lease obligation to the incoming owner, as long as the new homeowner is interested and meets the credit requirements of SolarCity.

If a homeowner chooses to buy out the lease prior to the end of its term, SolarCity will charge a "make-whole" payment, in addition to the fair market value (FMV) of the system. The make-whole payment captures the return on the investment that SolarCity and Morgan Stanley would have earned if the PV system had remained in place for the original 15-year term.

As part of the lease contract, SolarCity must be added to the homeowner's insurance policy. The company reports that most customers have sufficient personal property coverage to insure the panels at no additional cost.

SolarCity released its first lease product in March 2008, and the company refined the price and service levels several times in response to customer feedback and competitive pressures. Now that the federal ITC has been reauthorized at 30% through the end of 2016, the company expects to install more than 10 MW of leased systems in 2009 (even with the removal of the residential ITC cap).

## Connecticut Solar Lease Program

In August 2008, the Connecticut Clean Energy Fund (CCEF) – along with its partners CT Solar Leasing, LLC (a subsidiary of U.S. Bancorp), AFC First Financial Corporation, and Gemstone Lease Management, LLC – announced a residential solar lease program for homeowners who meet certain household income requirements (200% or less[2] of the area's median income) (CCEF 2008a). This residential lease program is combined with CCEF rebates for residential PV systems to enhance the economic feasibility of individual projects (CCEF 2008b). More information is available at both the CCEF Web site and the Connecticut Solar Lease Web site (www.ctcleanenergy.com and www.ctsolarlease.com). Gemstone and AFC also are developing solar lease programs in other states.

### Terms of the Program

- CT Solar Leasing offers a zero down-payment lease with a 15-year initial term
- Lease payments are fixed for the initial 15-year term and paid monthly
- CT Solar Leasing provides estimates for monthly payments on its Web site.
  - $49/month for a 2 kW system
  - $97/month for a 4 kW system
  - $144/month for a 6 kW system
- At the end of the 15-year lease agreement, the homeowner can:
  - buy the system at its fair market value
  - extend the lease for five additional years at a reduced rate based on FMV
  - remove the system from the home (at the homeowner's expense, which CT Solar estimates will be approximately $2,500-$3,000 at current prices)

CT Solar expects many homeowners to extend their lease an additional five years at the end of the 15-year term. The monthly lease payment will be significantly less than the original payment because it will be based on the value of a depreciated asset (i.e., the future value of an older system). As noted, the current monthly lease payment for a 4 kW system is approximately $97 ($1,164/year). However, according to program administrators, it will be approximately $29 a month ($348/year) during the five-year extension period.

Under the Connecticut program, the homeowner is responsible for maintenance and repairs, including any replacement of the inverter (which for a residential system can cost as much as $3,000-$4,000). The Connecticut lease program is a state-sponsored initiative that directs homeowners to work with one of about 20 preapproved qualified installers versus the single-installer model of SolarCity. Including free maintenance in the multi-installer model is more complicated than doing so in the single-installer model (although this may change in the future). However, to offset some of the maintenance and repair burden, CT Solar creates a savings account for each homeowner under its Solar Dividends program. The company deposits 50% of the revenue generated by the sale of renewable energy certificates (RECs) – up to a price of $30/REC[3] – into an account for the homeowner, which can be used for future O&M costs (including inverter replacement), purchase of the system at the end of the lease term, or removal of the system. If REC prices exceed $30, 100% of the proceeds above $30 go into the homeowner's account.

If the homeowner sells the house, the lease can be transferred to the new homeowner (there are no income limits on the transfer to the new homeowner). Any homeowner qualifies as long as he/she has acceptable credit and can afford the lease payments. To terminate the lease agreement, the homeowner has to prepay all of the future lease payments and cover the cost of removing the system.

### Getting a CCEF Rebate

In response to the removal of the residential ITC cap, CCEF reduced the level of residential rebates for PV (effective October 28, 2008) to $4/watt for the first 5 kW and $2.50/watt for the next 5 kW, up to the limit of 10 kW (CCEF 2008c).[4] However, as of November 2008, due to a lack of funds, CCEF suspended the residential rebates for PV except for homeowners who participate in the solar lease program (CCEF 2008d). As a result, even with the removal of the ITC cap, the Connecticut homeowner likely will choose the solar lease option, given the loss of the up-front rebate.

With the rebate suspension, the homeowner interested in a 4 kW system forgoes an up-front cash incentive of approximately $15,000. This is partially offset by a $4,500 increase in the ITC to $10,500;[5] however, the net loss of incentives

[2] It is assumed that families with incomes 200% over the average do not need assistance.

[3] One REC equals one megawatt hour (MWh) of generation.

[4] Rebates are adjusted, usually downward, based on the expected performance of the system. According to the CCEF, the average rebate is 93% of the full amount. This implies that a 4 kW system would receive an up-front rebate of $14,880 versus $16,000 for an optimal system (or $3.72/watt instead of $4/watt).

[5] The ITC is calculated as follows: (Initial cost - CT rebate) * 30% = ($34,400 - 14,880) * 30% = $5,856. Without the CT rebate, the ITC is: $34,400 * 30% = $10,320, or a net ITC increase of about $4,500.

**Table 1. Electricity Prices with Different Types of Financing (15 years)**

| Type of financing | Levelized price of electricity (2008$/kWh) | Implied net price of electricity** (2008$/kWh) | Up-front payment | Monthly loan/lease payment |
|---|---|---|---|---|
| Cash Purchase | $0.30 | $0.18 | $19,500* | $0 |
| Home Equity Loan | $0.22 | $0.093 | $195* | $190 |
| CT Solar Lease | $0.20 | $0.072 | $0 | $97 |

*Does not include the $5,856 for the residential ITC because it will not be received until the homeowner files a tax return.
**Implied net price is the total levelized price of the installed system, minus the average annual price of electricity for residential consumers in that state.

**Table 2. Electricity Prices with Different Types of Financing (20 years)**

| Type of financing | Levelized price of electricity in kWh (2008$) | Implied net price of electricity (2008$/kWh) | Up-front payment | Monthly loan/lease payment (1-15 years ) | Monthly loan/lease payment (years 16-20} |
|---|---|---|---|---|---|
| Cash Purchase | $0.32 | $0.17 | $19,500 | $0 | $0 |
| Home Equity Loan | $0.22 | $0.073 | $195 | $190 | $0 |
| CT Solar Lease | $0.20 | $0.055 | $0 | $97 | $29 |

exceeds $10,000. In addition, the homeowner now has to finance the entire price of the system up-front – $34,500 – versus what would have been an investment of $19,500. Finally, it is possible that not all homeowners are able to use a tax credit of $10,500 in a single tax year. As a result, they will need to carry forward some of the tax credits, postponing the recapture of a portion of the initial investment.

## Comparison of Alternatives for Residential PV in Connecticut

The costs and cash flows associated with a new 4 kW PV residential installation in Hartford, Connecticut,[6] can be evaluated across a variety of financial structures. Options examined include a cash purchase, a 15-year home equity loan, and a 15-year lease. The final price of electricity of a PV system[7] to the homeowner was estimated on a per-kWh basis. The inputs for the solar lease model were obtained from conversations with Connecticut Solar Lease program administrators and promotional materials.

A key assumption is that the Connecticut residential rebates are restored (at the new, lower levels) for those who finance a system with a loan or cash. The analysis assumes that under the solar lease model, the homeowner either buys or pays to remove the system for $3,000 in year 15. Certainly, if the homeowner decides to extend the lease for five years or if the FMV of the system in year 15 is less than $3,000, the price of electricity under the lease option will decline. The five-year lease extension, also with a $3,000 purchase option, will be analyzed in the 20-year scenario.

[6]Hartford was selected because PV Watts 1.0 has solar resource data for this city.

[7]Each case assumes that the same PV system with the same orientation and tilt is installed, such that the same portion of electricity is offset from the utility. In addition, the remaining electricity demand from the homeowner not covered by the PV system (and therefore the remaining utility bill) is not considered here.

The analysis computes two different prices of PV electricity generated. In the first set of calculations, the installed cost of the system, the ongoing maintenance expenses, REC revenue, rebates, tax credits, and other related cash flows over both a 15-year and 20-year period are divided by the number of kWh produced over an equivalent time period. This result is called the levelized price of electricity.

The second set of calculations incorporates the retail utility bill savings as a result of self-generating some of the home's electricity needs. Retail electricity prices are projected to escalate at a rate of 3% per year. If this projection is accurate, the homeowner with a PV system benefits by having a much lower net price of electricity for the PV generation. This result is labeled the implied net price of electricity.

For each of the three financing options, the analysis assumed that the homeowner will incur similar maintenance expenses while receiving the same benefits from the PV system. Therefore, the assumptions related to the cost of system maintenance, the cost and timing of the inverter replacement, the retail electricity savings, and the revenue from selling solar RECs are the same in each case. As a result, any modifications to these assumptions will not change the relationship among the three models. All of the remaining assumptions for the analysis can be found in Appendix 1.

As Table 1 illustrates, financing a residential PV system through a solar lease results in the most attractive levelized price of electricity and implied net price over a 15-year period. The lease is cheaper (cost per kWh) than the home equity loan and both are significantly less costly than the cash purchase option. With the exception of the second year, when the homeowner using a home equity loan gets a significant tax credit (which results in positive cash flow for

that year); and in year 15, when the homeowner using the lease purchases the PV system (or pays to have it removed), the annual cash flows favor the lease (over the home-equity loan). Using cash to purchase a PV system is the most expensive option given the immediate expense of $19,500 to pay for the system as well as the foregone investment income on this amount. If this foregone investment income is excluded from the analysis, the cash purchase – while still the most costly – is significantly less expensive.

Recognizing that PV systems have a productive life of more than 15 years, the analysis of the price of electricity under the three scenarios was extended to 20 years. In the home-equity loan example, the homeowner pays off the loan in year 15. In the case of the solar lease, the homeowner will extend the lease for an additional five years at a monthly price of $29 and then buy the system in year 20 for $3,000. The remaining assumptions do not change. As Table 2 indicates, the relationship among the three models remains the same, with the solar lease as the cheapest alternative. However, in years 16-20, the cash flows favor the home-equity loan (compared to the lease) because the loan has been paid off; with the lease, payments continue but at a significantly reduced level.

It is important to emphasize that if the residential rebates in Connecticut are not restored for homeowners who want to purchase the system outright rather than lease it, the financial advantage of the solar lease will be much greater than what is indicated in the tables.

**Appendix 1. Assumptions for 15-year Analysis**

| **Residential Solar Lease Hartford, Connecticut** | |
|---|---|
| Electricity production (kWh) in first year[1] | 4,627 |
| Annual degradation factor | 0.5% |
| Retail cost of electricity (kWh)[2] | $0.18 |
| Annual increase in price of retail electricity | 3.00% |
| Size of PV system (kW) | 4 |
| Cost per watt[3] | $8.60 |
| Up-front cost of system | $34,400 |
| Connecticut PV rebate per watt up to 5 kW as of October 28, 2008. | $4.00 |
| Incentives for this system (93% average) | $14,880 |
| Cost of system after rebate | $19,520 |
| Investment tax credit (ITC) | $5,856 |
| Discount rate | 8.0% |
| Inflation rate | 3.5% |
| Savings rate | 3.0% |
| Tax rate | 25% |
| Maintenance costs per year (as a percent of the up-front cost of the system) | 0.4% |
| Inverter replacement (cost per watt-DC)[4] | $0.95 |
| Inverter replacement | $3,800 |

| **Home-Equity Loan (15 years)** | |
|---|---|
| Term of loan[5] | 15 |
| Interest Rate[6] | 8.0% |
| Financing fee | 1.00% |

| **CT Solar Lease (15 years)** | |
|---|---|
| Estimated monthly lease payment[7] | $97 |
| End-of-term cost (remove or buy)[8] | $3,000 |
| SREC price per MWh[9, 10] | $25 |
| Financing fee | $0 |
| | |
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| 6. Citizens Bank, http://www.citizensbank.com/pf/homeequityloans/loan.aspx# | |
| 7. CT Solar Lease Program, http://ct-solarlease.com/documents/CTSolarGuide01-14-09_000.pdf | |
| 8. CT Solar Lease Program | |
| 9. Evolution Markets. July 2008. CT Class 1 REC Price, http://new.evomarkets.com/ | |
| 10. Assumption is that homeowner gets 50% of market price for RECs given the small number of RECs he or she has to sell each year. As a result, the REC income stream for the home equity and cash models is equal to the solar lease model. | |

## Conclusions

The emergence of the solar lease has created a new model to finance the cost of a residential PV system, particularly in markets with good PV incentives. As the overview of SolarCity and CT Solar Lease illustrates, lease programs will vary by the type of payment (fixed or adjustable), the term of the lease, and responsibility for system maintenance and repairs.

The solar lease programs in the market today were created in an environment where there were significant differences in the tax treatment for commercially owned systems versus residential ones. However, now that the cap on the residential ITC has been removed, one advantage of the solar lease has been eliminated. But, as illustrated by the reduction and subsequent suspension of residential rebates in Connecticut, the residential solar lease still can be an attractive financial structure compared to other available sources of financing.

Regardless, the removal of the residential ITC cap does increase the importance of promoting other aspects of the solar lease model, especially in those areas where the residential rebates for PV remain unchanged. Outsourcing the O&M of the PV system to the lessor is one advantage of the solar lease model. Some homeowners may prefer hassle-free solar electricity even if the price per kilowatt hour is higher. In addition, homeowners may not be able to pay for the PV system outright or qualify for a loan. So, for some homeowners, a solar lease may be the only financing option. Finally, the solar lease program administrator may be a more effective aggregator of solar RECs. With more RECs to sell, the program administrator can likely sell them at a higher price compared to the individual homeowner who has just a few solar RECs to sell each year. Therefore, as illustrated in this analysis, homeowners need to evaluate both the financial and nonfinancial aspects of the options available to them as they seek financing for the installation of a PV system. In many cases, the solar lease will be the best choice.

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