



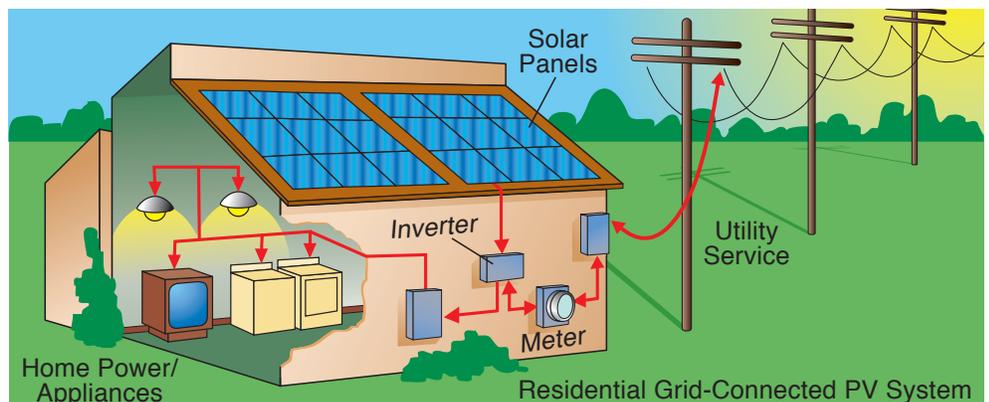
Credit: Altair Energy, PIX 07900

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 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.

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.

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



Credit: Davis Energy Group, PIX 13639

compensate the homeowner on a per-kWh basis for the shortfall.

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.

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). PACE² 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,

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.

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.

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.



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
1-877-EERE-INFO (1-877-337-3463)
www.eere.energy.gov/informationcenter

DOE/GO-102010-3129 • October 2010