



CONNECTICUT CONSUMER'S GUIDE TO

buying a solar electric system

[PHOTOVOLTAIC OR "PV"]



# solar

Are you thinking about buying a solar electric system for your home or business? If so, this booklet will provide basic information that you need to know.

Throughout Connecticut, people like you are showing increased interest in solar electric systems for their homes and businesses. These photovoltaic, or PV systems allow you to produce your own electricity with no noise, no air pollution, and no moving parts while using a clean, renewable resource—the sun.

To make PV systems more affordable for Connecticut consumers, incentives are available to you from the Connecticut Clean Energy Fund.

This consumer's guide is designed to provide you with information and available resources to lead you through the process of buying a solar electric system. A PV system can be a substantial investment, and as with any investment, careful planning will help ensure that you make the right decisions.

**Note:** This is not a technical guide for designing or installing your system—for that information we recommend that you consult an experienced PV system designer or supplier who will have detailed technical specifications and other necessary information.

The Connecticut Clean Energy Fund invests in technology to support the creation of supply from renewable sources and fuel cells in order to strengthen Connecticut's economy, protect community health, improve the environment, and promote a secure energy supply for Connecticut. The Fund, financed by a surcharge on ratepayers' electric utility bills, is administered by Connecticut Innovations.



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# background ▼

## WHAT IS A SOLAR ELECTRIC, OR PHOTOVOLTAIC SYSTEM?

Photovoltaic (PV) technology converts sunlight directly into electricity. It works any time the sun is shining. The greater the intensity of light (e.g. a sunny day) and the more direct the beam (e.g. perpendicular to the PV panel) the more electricity the PV module will produce. PV modules are quite different from the solar thermal systems for heating water that were popular in the late 1970s. PV technology does not use the sun's heat to make electricity. Instead, PV systems produce electricity directly from the electrons freed by the interaction of sunlight (photons) with semiconductor materials in the PV cells. PV modules are widely used to provide power to mobile message boards, emergency call boxes and cameras on the highway as well as cellular phone towers and small remote lighting. Once you see one, you'll start noticing them everywhere.

You don't need to understand the detailed physics of how PV works to understand its appeal: PV systems are reliable, pollution free, and use a renewable source of energy so that you don't need to worry

about running out of fuel. And, many PV system components are manufactured in the United States. Due to these unique characteristics, PV technology may be considered the ultimate energy source for the 21st century.

The basic building block of PV technology is the solar "cell." Multiple PV cells are connected to produce a PV "module," the smallest PV component sold commercially. These modules range in power output anywhere from 2 watts to 300 watts. A PV system connected or "tied" to the utility grid consists of the following:

- One or more PV modules, which are connected to an inverter
- The inverter, which converts the system's direct-current (DC) electricity to alternating current (AC)
- Batteries (optional), which provide back-up power in case of a power interruption on the grid
- Disconnects, grounding and metering that professional installers must provide

AC electricity generated by PV systems is compatible with the utility grid and able to power devices such as lights, appliances, computers, and televisions.

## WHY SHOULD I BUY A PV SYSTEM?

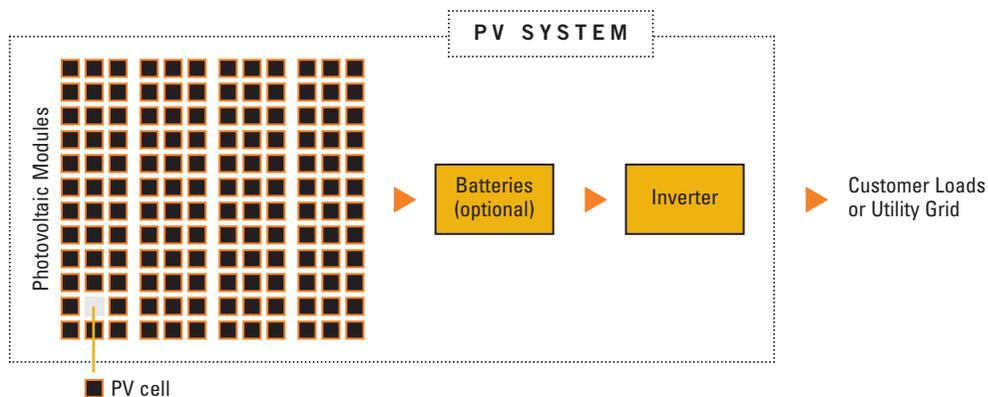
People decide to buy PV systems for a variety of reasons. Some people want to help preserve the earth's finite fossil fuel resources and reduce air pollution. Others would rather spend their money on an energy-producing improvement to their property instead of sending their money to a utility. Some people like the security of reducing the amount of electricity they buy from their utility because it makes them less vulnerable to future increases in the price of electricity. Finally, some people just don't like paying utility bills and appreciate the independence that a PV system provides.

Whatever your reason for considering purchasing a photovoltaic system, solar energy is widely thought to be the energy source of choice for the future. Residents of Connecticut may have a unique opportunity to take advantage of a state-sponsored program through the Connecticut Clean Energy Fund (CCEF) and other initiatives to help make a solar PV system their energy choice for today and tomorrow.

As you consider a PV system, consider the following:

- The brighter and more direct the sunshine, the more power the PV system will produce. Lack of sunshine is not a problem for systems connected to the utility grid, because any shortfall in the electricity you need is automatically delivered to you by your utility. If your system is not connected to the grid, or if you are grid-connected but want to have emergency power when the grid is down, you will need a battery bank to provide power when the sun is not shining.
- A number of factors will determine your overall costs and savings—like the future price of electricity, how long your system is operational, and the effects of policies that impact solar energy value. Unlike electricity purchased month by month from a utility, PV power comes with a

high initial investment and no monthly charge thereafter. This means that buying a PV system is like paying years of electric bills up front. You'll probably appreciate the reduction in your monthly electric bills, but the initial expense may be significant. Improved manufacturing has reduced the cost of PV equipment to less than 1% of what it was in the 1970s, but the cost (amortized over the life of the system) is still about 25 cents per kilowatt-hour. This cost is roughly twice the direct retail price that most Connecticut residents now pay for electricity from their utilities. Combining rebates and net metering with tax-deductible, low-interest financing could mean cost savings over the life of your PV system, especially if electricity prices keep climbing.





# investing in a PV system ▼

## WHAT MAKES A GOOD LOCATION FOR A PV SYSTEM?

### Where to install your PV system

The best location to install a PV system is on a south-facing roof. In Connecticut, the sun is always in the southern half of the sky and is higher in the summer and lower in the winter. Roofs that face east or west may also be acceptable under certain conditions, but the PV system will not perform as well as it will with direct southern exposure.

Your solar modules can be installed on the ground if a rooftop can't be used. The modules can be placed on either a fixed mount or a "tracking" mount that follows the sun to orient the PV modules for maximum performance. The tracking mount will help your system generate more electricity. However, you should evaluate this option carefully to

determine if you can expect enough additional electricity to justify the cost of the tracking system.

Other location options include mounting structures that create covered parking or provide shade as window awnings. These options are used most often in multifamily or commercial applications.

### Proper orientation for good performance

A 35 to 50 degree roof tilt is optimal for year-round energy production. The orientation of your PV system (the compass direction that your system faces) will affect its performance. Flat roofs also work well for solar-electric systems because the PV modules can be mounted flat on the roof facing the sky, or mounted on frames tilted toward the south at the optimal angle.

### Clear access to the sun for most of the day

To make the best use of your PV system, the PV modules must have a clear "view" of the sun for most or all of the day — unobstructed by trees, roof gables, chimneys, buildings, and other features of your home and the surrounding landscape. Note that even though the area where a system is mounted may not be shaded during one part of the day, it may be shaded during another. If this is the case, then this shading may substantially reduce the amount of electricity that your system will produce. You can make an initial assessment yourself, and if the location looks promising, your PV system provider has the tools to trace the sun's path at your location and determine whether your home or business can make use of a solar electric system.



### **Adequate space on your roof or property**

The amount of space needed by a PV system is based on the physical size of the system you purchase. Most residential systems require as little as 50 square feet (for a small “starter” system) up to as much as 1,000 square feet. An average 2 kilowatt (kW) residential system in the U.S. covers about 250 square feet. If your location limits the physical size of your system, you may want to install a system that uses more efficient PV modules. Greater efficiency means that the module uses less surface area to convert sunlight into a given amount of electric power. PV modules are available today in a range of types, and some offer more efficiency per square foot than do others. Depending on several factors, the cost of a system using higher-efficiency modules can be comparable to the same system using low-efficiency modules. System sizing is covered

later in this booklet and should be discussed with your PV system provider.

### **A roof in good condition**

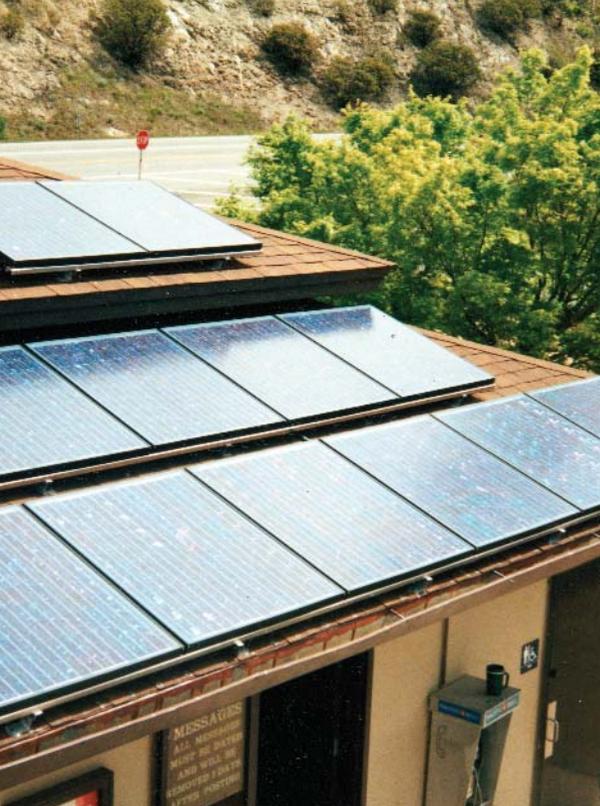
Some roof types are simpler and easier to work with, but a PV system can be installed on almost any type. Typically, composition shingles are easiest to work with, and slate is the most difficult. In any case, an experienced solar installer will know how to work on all roof types and can use roofing techniques that eliminate any possibility of leaks. As a secondary benefit, because the PV modules absorb the sun’s radiation, they do protect the roofing material underneath from its damaging effects, while keeping the roof cooler. Ask your PV provider how the PV system affects your roof warranty.

If your roof is older and needs to be replaced in the

very near future, you may want to replace it at the time the PV system is installed to avoid the cost of removing and reinstalling your PV system. Some PV modules are designed to be integrated into the roof itself, replacing standard three-tab shingles. There are also modules that are laminated to standing seam metal roof sections. These systems have a higher aesthetic value and offer the ability to offset the cost of roof materials.

### **HOW BIG SHOULD MY PV SYSTEM BE, AND WHAT FEATURES SHOULD IT HAVE?**

As a starting point, consider how much of your present electricity needs you would like to meet with your PV system. For example, suppose that you would like to meet 50% of your electricity needs with your PV system. You could work with your PV system provider to examine past electric bills and



determine the size of the PV system needed to achieve that goal.

You can contact your utility and request the total electricity usage, measured in kilowatt-hours, for your household or business over the last 12 months (or consult your electric bills if you save them). Ask your PV provider how much energy your new PV system will produce on an annual basis (also measured in kilowatt-hours) and compare that number to your annual electricity demand to get an idea of how much you will save. In the next section, we will provide more detail on estimating how much you will save.

One optional feature you might consider is a battery system to provide back-up power in case of a utility power outage. Batteries add value to your system, but at an increased price.

As you size your system, you should consider the “economies of scale” that can decrease the cost per kilowatt-hour as you increase the size and cost of the system. For example, many inverters are sized for systems up to 5 kilowatts; if your PV array is smaller (say 3 kW), you may still end up buying the same inverter. It can offer a more efficient operation and the ability to expand the system. Labor costs for a small system may be nearly as much as those for a large system. Therefore, it is worth remembering that your PV provider is likely to offer you a better price to install a 2 kW system all at once, than to install a 1 kW system this year and another similar system next year.

#### HOW MUCH DOES A PV SYSTEM COST?

Your system’s price will depend on whether the home is existing or under construction, and if the PV

## roof area needed ▼

ROOF AREA NEEDED IN SQUARE FEET (SHOWN IN BOLD TYPE)

| PV module efficiency* (%) | PV Capacity Rating (watts) |           |            |            |            |              |              |               |
|---------------------------|----------------------------|-----------|------------|------------|------------|--------------|--------------|---------------|
|                           | 100                        | 250       | 500        | 1,000      | 2,000      | 4,000        | 10,000       | 100,000       |
| 4                         | <b>30</b>                  | <b>75</b> | <b>150</b> | <b>300</b> | <b>600</b> | <b>1,200</b> | <b>3,000</b> | <b>30,000</b> |
| 8                         | <b>15</b>                  | <b>38</b> | <b>75</b>  | <b>150</b> | <b>300</b> | <b>600</b>   | <b>1,500</b> | <b>15,000</b> |
| 12                        | <b>10</b>                  | <b>25</b> | <b>50</b>  | <b>100</b> | <b>200</b> | <b>400</b>   | <b>1,000</b> | <b>10,000</b> |
| 16                        | <b>8</b>                   | <b>20</b> | <b>40</b>  | <b>80</b>  | <b>160</b> | <b>320</b>   | <b>800</b>   | <b>8,000</b>  |

**NOTE:** While module efficiency is a primary factor in determining square footage, there are other factors that can increase necessary coverage, including type of mounting system, thermal expansion considerations, obstructions, roof orientation and roof layout. Therefore, the table at left should be used only as a guide.

\* Although the efficiency (percent of sunlight converted to electricity) varies with the different types of PV modules available today, higher-efficiency modules typically cost more. So, a less-efficient system is not necessarily less cost-effective.

system is integrated into the roof or mounted on top of an existing roof. The price also varies depending on the PV system rating, manufacturer, retailer, and installer.

The *size* of your system may be the most significant factor in any equation measuring your costs against your benefits.

- Small, single PV-panel systems with built-in inverters that produce about 75 watts may cost around \$900 installed, or \$12 per watt. These small systems will offset only a small fraction of your electricity bill.
- A 2 kW system may cost \$16,000 to \$20,000 installed, or \$8 to \$10 per watt.
- At the high end, a 5 kW system that will completely offset the energy needs of many conventional homes may cost \$35,000 to \$45,000 installed, or \$7 to \$9 per watt.

These prices, of course, are just rough estimates,

and your costs will depend on your system's configuration, your equipment options, and other factors. Your local PV providers can provide you with estimates or bids.

### WHAT INCENTIVES ARE AVAILABLE TO REDUCE THE COST?

There are many incentives to encourage Connecticut homeowners to install solar electric systems.

**Connecticut Clean Energy Fund Rebate Program for Residential PV Systems**—The CCEF provides a rebate incentive to encourage the installation of grid-connected solar PV systems on residences in Connecticut. The CCEF is financed by a surcharge paid by electrical ratepayers within the Connecticut Light & Power (CL&P) and United Illuminating Company (UI) service territories. The CCEF is administered by Connecticut Innovations, Inc.,

which is a quasi-public agency of the State of Connecticut.

Rebates are available to Connecticut homeowners through installation companies that have been designated as eligible to participate in the CCEF Residential Solar PV program. A list of eligible installers as well as information about the program can be found on CCEF's website, [www.ctcleanenergy.com](http://www.ctcleanenergy.com).



## reduction of utility electric bill ▼

### CALCULATING UTILITY ELECTRIC BILL REDUCTION FOR A NET-METERED PV SYSTEM

1. Find the estimated annual system output to the right that correlates best with your location and the anticipated size of the PV system

2. Multiply this estimated annual system output by your electric utility rate (e.g., 12 cents/kWh = \$0.12/kWh) to get your annual electric bill reduction.

Example: A 2kW (2,000 watts) system in Hartford with an electric rate of \$0.12/kWh will reduce electric utility costs by approximately \$298 per year. (2,486 KWh/year x \$0.12/kWh = \$298/year.)

| Location   | Estimated Annual System Output (kWh per Year) |       |       |       |       |
|------------|---|-------|-------|-------|-------|
|            | 1 kW  | 2 kW  | 3 kW  | 4 kW  | 5 kW  |
| Hartford   | 1,243   | 2,486 | 3,729 | 4,972 | 6,215 |
| Bridgeport | 1,281   | 2,563 | 3,844 | 5,126 | 6,407 |

The CCEF Solar Rebate Program requires that systems be covered by a full parts and labor installation warranty, in addition to any manufacturers' warranties on specific components.

**Net Metering**—In Connecticut, if you are a customer of CL&P or UI, you are eligible for net metering. Under net metering, the customer is billed for the “net” electricity purchased from the utility over the entire billing period — that is, the difference between the electricity coming from the power grid and the electricity generated by the PV system. Hence, the monthly reading indicates net

customer usage. Through net metering, the customer obtains the full retail electricity rate — rather than the much lower wholesale rate — for kilowatt-hours of PV-produced electricity sent back to the utility power grid. The consumer benefits of net metering are especially significant in areas that have high retail electricity rates. Utilities also benefit because the solar-generated energy often

coincides with their peak demand. See page 14 for details on obtaining utility net metering benefits.

**Exemption from Increased Property Tax**—Installing a PV system adds value to your home. Many states have provisions that exempt homeowners from paying more in property tax due to the installation of a solar energy system. This exemption is not automatic in Connecticut; rather, local governments have the option to exempt solar energy systems from property taxes. Contact your local tax assessor's office to determine whether your city or town allows this exemption.

**Low-Interest Energy Conservation Loan**—The Connecticut Housing Investment Fund offers loans to income-eligible residents who want to finance a solar PV system. Amounts up to \$15,000 can be borrowed for this purpose, for terms up to 10 years and at interest rates as low as 1%, 3%, and 6%, based upon income, family size and location. For more information contact the Connecticut Housing

Investment Fund at (800) 992-3665, ext. 2019 or 2023 for income guidelines for your area or visit their website at [www.chif.org](http://www.chif.org) and click on the homeowner's channel. They may also be reached by e-mail at [loans@chif.org](mailto:loans@chif.org).

**Renewable Energy Certificates and Reward Programs**—Certain private companies and non-profit organizations offer payments or incentives to owners of solar electric systems for the “renewable energy credits” or “green tags” associated with producing renewable energy. Green tags represent the environmental attributes associated with electricity generation from renewable energy technologies — not the electricity itself. Information on these organizations can be found on Solar Connecticut's website, [www.solarconnecticut.org](http://www.solarconnecticut.org) or CCEF's website, [www.ctcleanenergy.com](http://www.ctcleanenergy.com).

**Database of State Incentives for Renewable Energy**—Established in 1995, the Database of State Incentives for Renewable Energy (DSIRE) is an ongoing project of the Interstate Renewable Energy Council (IREC), funded by the U.S. Department of Energy and managed by the North Carolina Solar Center. Their website, [www.dsireusa.org](http://www.dsireusa.org), has additional information on current state and federal renewable energy incentive programs.



## HOW CAN I FINANCE THE COST OF MY PV SYSTEM?

One of the best ways to finance a residential PV system is through a mortgage loan or a home-equity loan that is secured by your property. There are two advantages to mortgage financing. First, mortgage financing usually provides longer terms and lower interest rates than other loans such as conventional bank loans. Second, the interest paid on a mortgage loan is generally deductible on your federal taxes (subject to certain conditions). If you buy the PV system at the same time that you build, buy, or refinance the house on which the PV system will be installed, adding the cost of the PV system to your mortgage loan is likely to be relatively simple and may avoid additional loan application forms or fees. If mortgage financing is not available, look for other sources of financing, such as conventional bank loans. Remember to look for the best possible combination of low rate and long term. This will allow you to amortize your PV system as inexpensively as possible. Because your PV system is a long-term investment, the terms and conditions of your PV system financing are likely to be the most important factor in determining the effective price of your PV-generated power.

## HOW MUCH WILL I SAVE WITH MY PV SYSTEM?

The value of your PV system's electricity will depend on how much electricity you consume, how much you pay your utility for electricity and how much your utility will pay you for any excess that you generate. If your utility offers net metering (and therefore pays the full retail price for your excess electricity), your calculation may be fairly easy because you and your utility will each pay the same price for each other's electricity. You can use the calculation box (page 7) to approximate roughly how much electricity your PV system will produce and how much that electricity will be worth. Keep in mind that actual energy production from your PV system can vary by up to 20% from these figures, depending on your geographic location, the angle and orientation of your system, the quality of the components of your system, and the quality of the installation. Consider asking the installer for a written estimate of the average annual energy production from the PV system. However, even if an estimate is accurate for an average year, actual electricity production will fluctuate from year to year due to natural variations in climate.

Many PV owners also report a much greater awareness of energy usage, which then influences their selection of appliances that consume less electricity and ultimately reduces energy consumption.



# selecting a PV provider ▼

## WHO SELLS AND INSTALLS PV SYSTEMS?

The CCEF has selected a group of experienced PV system providers based on a competitive application process to install PV systems for homeowners who want to take advantage of the rebate incentive. The list of eligible participating installers can be obtained from CCEF's website at [www.cleanenergy.com](http://www.cleanenergy.com) or by contacting CCEF.

## HOW DO I CHOOSE AMONG PV PROVIDERS?

Contact several providers and find out what products and services they offer. Check references, seek as much information as possible and obtain quotes from several installation companies. And be sure you are comfortable working with the provider—you want to have confidence in his/her advice and judgment.

The following questions may assist you in determining installer capabilities:

- How many years of experience does the company have installing PV systems?
- Has the company installed grid-connected PV systems? If not, has it installed grid-independent PV systems?
- Will the provider be responsible for permits and adhere to codes and standards?
- Will the installer provide you with a list of their customers and phone numbers for you to call?
- Is the company properly licensed?

*PV systems should be installed by an appropriately licensed contractor. Under Connecticut Law, a licensed electrical contractor (E-1) must perform the electrical work on the installation. The State Department of Consumer Protection (860) 713-6000 can tell you whether a contractor has a valid electrician's license, or you can check online at <http://www.dcpaccess.state.ct.us>. Local building departments also may require that the installer have a general contractor's license. Consumers should call the city and county in which they live for additional information on licensing.*

- Does the company have complaints against it?  
*As with any project that requires a contractor, due diligence is recommended. The State Department of Consumer Protection (860) 713-6000, or online at <http://www.dcpaccess.state.ct.us> can tell you about any judgments or complaints against a state-licensed electrician. Consumers should call the city and county in which they live for additional information on how to check up on contractors. The Better Business Bureau is another source of information on contractors. The Connecticut Bureau can be reached at (203) 269-2700 or online at <http://www.connecticut.bbb.org>. Complaints should be filed with the State of Connecticut, Department of Consumer Protection, the Connecticut Better Business Bureau and a copy sent to the CCEF.*



### HOW DO I CHOOSE AMONG COMPETING BIDS?

If you have decided to get more than one bid for the installation of your PV system (and it's generally a good idea to do so), you should take steps to ensure that all the bids you receive are made on the same basis. For example, comparing a bid for a system mounted on the ground against another bid for a rooftop system is like comparing apples to oranges. Similarly, different types of PV modules generate more electricity per square foot than others. *Bids should clearly state the maximum generating capacity of the system (measured in watts or kilowatts). If possible, have the bids specify the system capacity in "AC watts".*

*You may want to obtain some estimate of the amount of energy that the system will produce*

*on an annual basis (measured in kWh).*

Because the amount of energy depends on the amount of sunlight — which varies by location, season, and year to year — it is unrealistic to expect a specific figure. A range of  $\pm 20\%$  is more realistic. Bids also should include the total cost of getting the PV system up and running, including hardware, installation, connection to the grid, permitting, sales tax, and warranty.

*Your warranty is a very important factor for evaluating bids.* The CCEF Solar Rebate Program requires that systems be covered by a full parts and labor installation warranty, in addition to any manufacturers' warranties on specific components. The installer may offer longer warranties. Also ask yourself, "Will this

company stand behind the full-system warranty for the next five years?"

# before connecting a PV system to the



## **WHAT SHOULD I KNOW ABOUT PERMITS?**

If you live in a community in which a homeowners' association requires approval for a solar electric system, you or your PV system provider may need to submit your plans. Gain approval from your homeowners' association before you purchase your PV system. If the approval is denied, contact one of the groups under Getting Help inserted in the back of this booklet.

Most likely, you will need to obtain permits from your city or county building department. You will probably need a building permit, an electrical permit, or both before installing a PV system. Typically, your PV system provider will take care of this, rolling the price of the permits into the overall system price. However, in some cases, your PV provider may not know how much time or money will be involved in "pulling" a permit. If so, this task may be priced on a

time-and-materials basis, particularly if additional drawings or calculations must be provided to the permitting agency. In any case, make sure the permitting costs and responsibilities are addressed at the start with your PV provider.

## **WHAT SHOULD I KNOW ABOUT CODES AND STANDARDS?**

You don't need to fully understand these standards, but your PV provider and utility should. It is your obligation to ensure that your PV provider uses equipment that complies with the relevant standards, so be sure to discuss this issue.

Code requirements for PV systems vary somewhat from one jurisdiction to the next, but most requirements are based on the National Electrical Code (NEC) NFPA 70. The NEC has a special section, Article 690, which carefully spells out requirements for designing and installing safe, code-compliant PV systems. Because most local requirements are based on the NEC, your building inspector is likely to rely on Article 690 for guidance in determining whether your PV system has been properly designed and installed. If you are among the first people in



your community to install a grid-connected PV system, your local building department may not have approved one of these systems. If this is the case, you and your PV system provider can speed the process by working closely and cooperatively with your local building officials to help educate them about the technology and its characteristics.

National standards and guides for utility interconnection of PV systems are quickly being adopted by many local utilities. The most important of these standards and guides focuses on inverters. Traditionally, inverters simply converted the DC electricity generated by PV modules into the AC electricity used in our homes. More recently, inverters have evolved into remarkably sophisticated devices to manage and condition power. Many new inverters contain all the protective relays, disconnects, and other components necessary to meet the most stringent national standards. Three of these guides or standards are particularly relevant and are in effect for interconnection with the utility grid for customers of CL&P and UI:

- Institute of Electrical and Electronic Engineers, P929-2000: *Recommended Practice for Utility*

*Interface of Photovoltaic (PV) Systems*. Institute of Electrical and Electronic Engineers, Inc., New York, NY

- Institute of Electrical and Electronic Engineers, 1547-2003: *Standard For Interconnecting Distributed Resources with Electric Power Systems*. Institute of Electrical and Electronic Engineers, Inc., New York, NY
- Underwriters Laboratories, *UL Subject 1741: Standard for Static Inverters and Charge Controllers for Use in Independent Power Systems* (First Edition). Underwriters Laboratories, Inc., Northbrook, IL (November 1, 2002)

Standard PV modules should also come with a UL 1703 listing. It is also recommended that they are tested to IEC 61215 or IEEE 1262. This will be indicated on the solar module label.

### WHAT SHOULD I KNOW ABOUT INSURANCE?

Your electric utility will require you to enter into an interconnection agreement, described more fully in the next section. Usually, these agreements set forth minimum insurance requirements that you must keep in force. If you are buying a PV system for your home, your standard homeowner's insurance policy

is usually adequate to meet the utility's requirements. For example, both CL&P and UI require minimum liability insurance of \$300,000 for a system with a capacity of 10 kW or less.

### WHAT SHOULD I DO TO INTERCONNECT TO THE UTILITY COMPANY?

CL&P and UI have developed simplified, standardized interconnection procedures and agreements for small-scale PV systems up to 10 kW. The complete **CL&P and UI Guidelines for Generator Interconnection** for these two utilities, including application and sample interconnection agreement forms, may be downloaded from either company's website, for CL&P visit [www.cl-p.com/companyinfo/interconnection/interconnections.asp](http://www.cl-p.com/companyinfo/interconnection/interconnections.asp) and for UI visit [www.uinet.com/pdfs/generation.pdf](http://www.uinet.com/pdfs/generation.pdf). Getting an interconnection agreement for a residential-scale PV system (less than 10 kW) will typically proceed in the following way:

1. Your installer will assist you in submitting a completed 2-page interconnection application to your utility, including:
  - A one line electrical drawing depicting the proposed system design;
  - A general site plan of the proposed installation;
  - The proposed schedule for the in-service date; and
  - The technical specifications for the equipment.The interconnection application fee for PV systems less than 10 kW is \$100. CL&P customers can file their applications online.
2. Your utility will then review the application, notify you if any information is missing, and complete the processing within 20 business days of receiving your completed application.
3. You then must complete, sign and submit a *Standard Interconnection Agreement* provided by your utility.

Connecting your PV system to the utility grid will require you to enter into an interconnection agreement with your local utility. The interconnection agreement specifies the terms and conditions under which your system will be connected to the utility grid. These will include your obligation to obtain permits and insurance, maintain the system in good working order, and operate it safely.

4. Notify your utility in writing that your PV system installation is complete, has been approved by the electrical inspector and is ready to be tested. This must be done at least 10 business days before the system is connected to the utility grid.
5. A representative from your utility will come to your home to witness a commissioning test to ensure that your PV system is operating properly. There will be no charge for this test as long as the testing is completed in one visit. Upon a successful test, the utility will approve the system for interconnection.

#### DOES MY PV SYSTEM QUALIFY FOR NET METERING?

Net metering is a policy allowing utility customers with small, renewable generating facilities to sell their excess electricity back to the utility. When a customer's generating equipment is producing more electricity than is being used, the excess power is metered and sent back into the grid. At the end of the billing period, the customer will be billed for the *net amount* of power consumed. Net metering is **NOT** a requirement for interconnection to the utility's electric power system.

Residential rate customers with PV systems, with an installed generating capacity of 100 kW or less, meet the "qualifying facility" requirements for net metering. CL&P offers net metering service to their customers via Rider N Self-Generator Net Energy Billing Service. UI offers net metering service to

customers via Qualifying Facility Net Energy Rider NE.

For billing periods when the PV generation exceeds purchases from the utility (i.e. net metering results in sales to the utility), CL&P purchases the net output under the terms of Rate 980 Non-Firm Power Purchase. UI purchases the net output under the terms of Self-Generator Rate SG2. CL&P's tariffs are available at [www.cl-p.com/esupplier/rates.asp](http://www.cl-p.com/esupplier/rates.asp) and UI's tariffs are available at [www.uinet.com/suppliers/download/RateTariff.pdf](http://www.uinet.com/suppliers/download/RateTariff.pdf), look for CUPCA No. 159 Rider NE and rate SG2 CUPCA No. 337.

If you are a customer of a municipal utility or electric cooperative that does not offer net metering, it will probably require you to use two meters: one to measure the flow of electricity *into* the building, the other to measure the flow of electricity *out* of the building. If net energy metering is not available, the utility will only pay you a *wholesale* rate for your excess electricity. In this case, you will have a strong incentive to use all the electricity you generate so that it offsets electricity you would otherwise have to purchase at the *retail* rate. Talk to your installer to optimize your system size to limit the excess electricity you generate.



### WHAT SHOULD I KNOW ABOUT UTILITY AND INSPECTION SIGN-OFF?

After your new PV System is installed, it must be inspected and “signed off” by the local permitting agency (usually a building or electrical inspector) and by the electric utility with which you entered into an interconnection agreement. Inspectors may require your PV provider to make corrections, but don’t be alarmed — this is fairly common in the construction business. A copy of the building permit showing final inspection sign-off is required for the installer to receive the approved rebate from CCEF. In addition, a CCEF representative has the right to make a reasonable number of visits to your site during and after installation of the PV system as a condition of receiving a rebate.

### WHAT SHOULD I KNOW ABOUT WARRANTIES?

Warranties are key to ensuring that your PV system will be repaired if something should malfunction during the warranty period. To be eligible for the CCEF rebate, your PV provider must cover your system with a five-year full warranty. The warranty must cover all components of the generating system against breakdown or degradation in electrical output of not more than 10% from the original rated electrical output. The warranty must cover the full costs, including labor and repair or replacement of

defective components or systems. In other words, even if the manufacturer’s warranty on a particular component is less than five years, the system vendor must still provide you with a five-year warranty. PV panels must have a 20-year warranty.

Be sure you know who is responsible for honoring the various warranties associated with your system — the installer, the dealer, or the manufacturer. The vendor should disclose the warranty responsibility of each party. Know the financial arrangements, such as contractor’s bonds, that assure the warranty will be honored. Remember, a warranty does not guarantee that the company will remain in business. Get a clear understanding of whom you should contact if there is a problem. To avoid any later misunderstandings, be sure to read the warranty carefully and review the terms and conditions with your retailer.





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