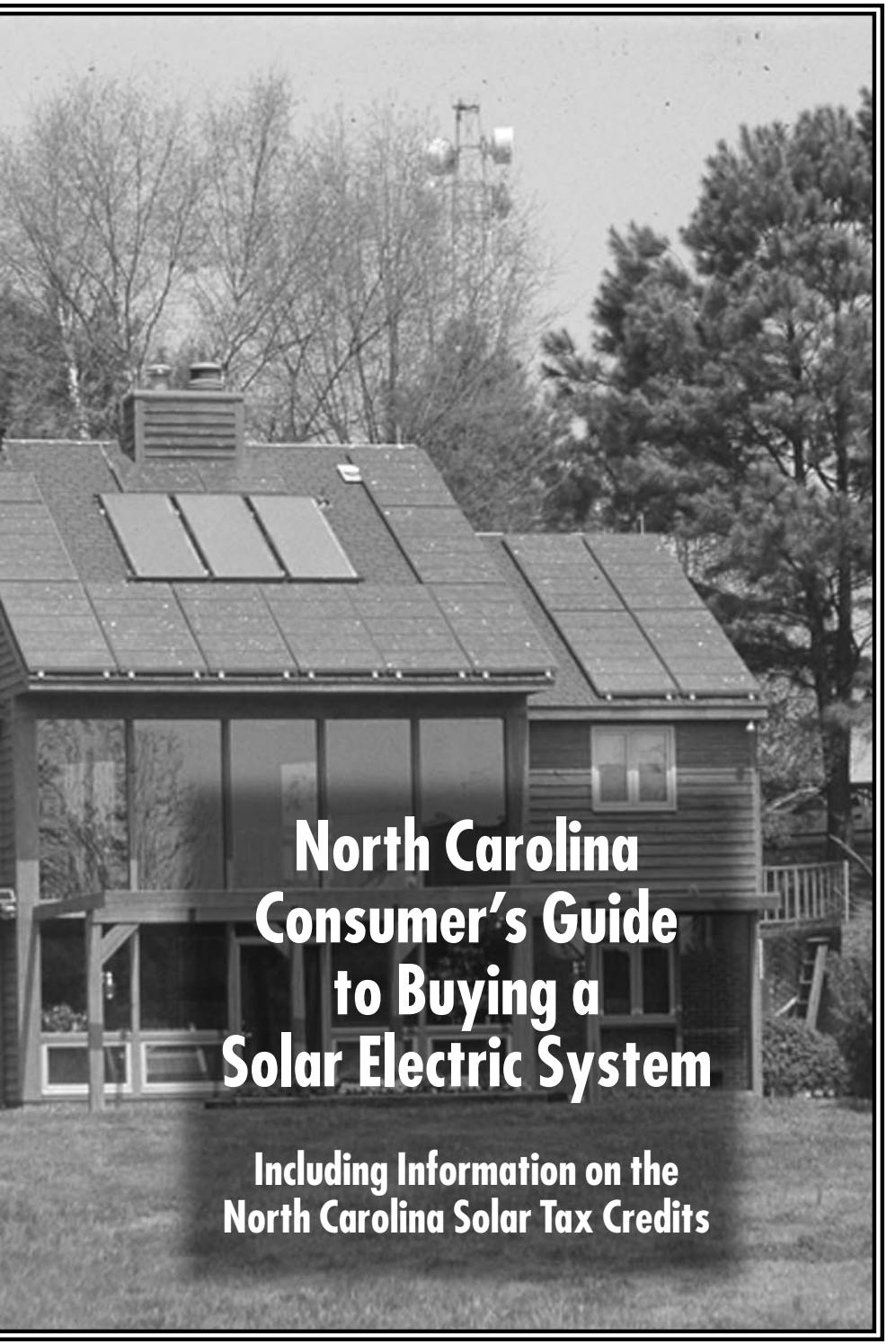


North Carolina Consumer's Guide to Buying a Solar Electric System

Including Information on the North Carolina Solar Tax Credits

Are you thinking about buying a photovoltaic system for your home or business?

If so, this booklet will provide basic information that you need to know. North Carolinians are showing increased interest in solar electric systems for their homes and businesses. These photovoltaic—or PV—systems are reliable, pollution free, and use a renewable source of energy—the sun. They are also becoming more affordable all the time. To make PV systems more affordable to North Carolina consumers, the North Carolina Department of Revenue offers financial incentives through solar tax credits.

This booklet is designed to guide you through the process of buying a solar electric system. A word of caution: 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 system supplier ("PV installer") who will have detailed technical specifications and other necessary information. A PV system can be a substantial investment, and as with any investment, careful planning will help ensure that you make the right decisions.

Contents

Background

What is a photovoltaic system?

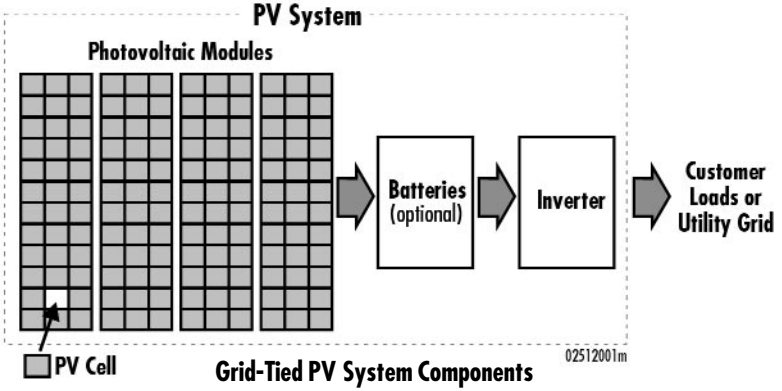
PV technology converts sunlight directly into electricity. It works any time the sun is shining, but more electricity will be produced when the light is more intense (a sunny day) and is directly over the PV modules. Unlike solar systems for heating water, which you might be more familiar with, PV technology does not use the sun's energy to generate heat and make electricity. Instead, PV produces electricity directly from the electrons freed by the interaction of sunlight with semiconductor materials in the PV cells.

But you don't need to understand the detailed physics of how PV works to understand its appeal: investing in PV allows you to produce your own electricity with no noise, no air pollution, and no moving parts while using a clean, renewable resource. A PV system will never run out of fuel, and it won't increase our oil imports from overseas. In fact, it won't even contribute to the trade deficit, because many PV system components are manufactured in the United States. Because of these unique characteristics, PV technology has been called the ultimate energy source for the 21st century.

The basic building block of PV technology is the solar "cell." PV cells are wired together to produce a PV "module," the smallest PV component sold commercially, and these modules range in power output from about 10 watts to 300 watts. A typical PV system consists of one or more PV modules connected to an inverter that changes the system's direct-current (DC) electricity to alternating current (AC). AC power is compatible with the utility grid and able to power common household devices such as lights, appliances, computers, and televisions. You may also include batteries in the system to provide back-up power.

What are the different PV system configurations?

PV systems are typically divided between on-grid (or "utility tied") and off-grid (or "independent"). Off-grid PV systems for homes or other buildings must have battery storage for times when PV power is not available. For on-grid systems, batteries are



Grid-Tied PV System Components

optional. One of the advantages of a grid-tied system is that you can use the utility as your back-up and forego the purchase of batteries. If you have a grid-tied system with batteries, you will be able to run your system and supply loads even when the utility power goes down.

What is the current status of the technology?

Before you decide to buy a PV system, you should understand the current status of the technology:

- First, it produces power intermittently because it works only when the sun is shining. This is not a problem for PV systems connected to the utility grid, because additional electricity you need is automatically delivered to you by your utility. And, systems with batteries can provide energy even when there is no sun.
- Second, PV-generated electricity is more expensive than conventional utility-supplied electricity. Improved manufacturing has reduced the cost to less than one percent 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 is roughly three times the retail price that most North Carolina residents now pay for electricity from their utilities. The solar tax credits help make PV more affordable, but it can't match today's price for electricity from your utility.
- Finally, 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 is not insignificant. By financing your PV system, you can spread the cost over many years.

What are the solar tax credits and how can I use them?

North Carolina's tax credits to support solar energy systems were originally created in 1977, and in 1994, the General Assembly revised and expanded the credits. Two North Carolina solar tax credits are available to reduce the cost of installing PV systems. One is for residential buildings and the other is for commercial and industrial buildings.

- **The residential solar tax credit** allows a 40% income tax credit with a maximum of $1,500, for the installation of a residential photovoltaic system. The credit is applicable to both personal and corporate income taxes. If the amount of the credit exceeds your North Carolina income tax liability in the year the credit is claimed, then any excess credit may be carried forward up to five years. This carryover provision is important for individuals with small tax liabilities.

  The residential solar tax credit is limited to the installation and equipment costs of photovoltaic systems and can only be counted for one system per year, per building. In other words, if you install two separate systems on your house in one single year, then you can only claim the credit for one system; but if you install one system in one year and another system in another year, then you can claim a credit for both systems. It should be noted that the credit can be taken for a system only after it is completely

installed and operational; so, a system begun in one year and completed and operational in the next can only be claimed on the next year's tax return.

- **The commercial and industrial solar tax credit** allows a 35% tax credit with a maximum of $25,000 for the installation of commercial or industrial photovoltaic systems. The credit is applicable to both personal and corporate income taxes, depending on ownership. The commercial and industrial solar tax credit, just as the residential, is limited to the installation and equipment costs of photovoltaic systems and can only be counted for one system per year, per building. Unlike the residential credit, no credit can be carried over to succeeding years.

100% of the cost—including installation of equipment necessary to collect, store and convert solar energy into useable electrical energy—is eligible for the North Carolina solar tax credits.

Commercial and industrial photovoltaic systems also qualify for a **10% federal corporate income tax credit.** This tax credit is outlined in brief as follows:

- The credit will not cover any of the cost provided by federal, state, and local grants, or programs that provide subsidized financing for projects designed to conserve or produce energy.
- The amount of this federal credit is not impacted by state and local tax credits or deductions.
- The equipment must be completely installed and operational in the year in which the credit is first taken.
- The credit may be carried forward for up to 15 years in the case where the credit exceeds a company's tax liability.

Federal law also allows a 5-year Modified Accelerated Cost Recovery System (MACRS) depreciation schedule for commercial and industrial photovoltaic systems.

9-kW PV system installed on the Intek fabric manufacturing plant in Aberdeen, NC. (credit: NCSC)

Investing in a PV system

Why should I buy a PV system?

People decide to buy PV systems for a variety of reasons. Some want to help preserve the earth's finite fossil-fuel resources and reduce air pollution. Others believe that it makes more sense to spend their money on an energy-producing improvement to their property than to send 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. Others like to be early adopters of high technology and want to support the advancement of high technology. Finally, some people just don't like paying utility bills and appreciate the independence that a PV system provides.

Whatever your reason, solar energy is widely thought to be the energy source of choice for the future, and North Carolinians have an opportunity to help make it their energy choice for today and tomorrow.

Is my home or business a good place for a solar system?

Can you orient your system for good performance?

A well-designed PV system needs clear and unobstructed access to the sun's rays for most or all of the day, throughout the year. You can make an initial assessment yourself, and if the location looks promising, your PV installer has the tools to trace the sun's path at your location and determine whether your home or business can make use of a PV solar system.

It is important to note that even though the area where a system is mounted may be unshaded 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. A well designed PV system will be unshaded for the six hours around noon on March 21 and September 23.

The orientation of your PV system (the compass direction that your system faces) will affect performance. In North Carolina, the sun is always in the southern half of the sky and is higher in the summer and lower in the winter. Usually, the best location for a PV system is a south-facing roof, but roofs that face east or west may also be acceptable. Flat roofs also work well for solar 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. For the most part, if your modules are oriented at slopes 45° or less and oriented within 30° of south, your system will provide at least 90% of the optimal energy output.

If a rooftop can't be used, your solar modules can also be placed on the ground, either on a fixed mount or a "tracking" mount that follows the sun to orient the PV modules for maximum performance. Other options (used most often in multifamily or commercial applications) include mounting structures that create covered parking or provide shade as window awnings.

Do you have enough area 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. Commercial systems are typically even larger. 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 higher efficiency than do others. System sizing is discussed later in this booklet and should also be discussed with your PV installer.

What kind of roof do you have, and what is its condition?

Some roof types are simpler and cheaper to work with, but a PV system can be installed on 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. Ask your PV installer 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. Panels often can be integrated into the roof itself, and some modules are actually designed as three-tab shingles or raised-seam metal roof sections. One benefit of these systems is their 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, you might 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 percent of your electricity needs with your PV system. You could work with your PV installer 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

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	**30**	**75**	**150**	**300**	**600**	**1,200**	**3,000**	**30,000**
8	**15**	**38**	**75**	**150**	**300**	**600**	**1,500**	**15,000**
12	**10**	**25**	**50**	**100**	**200**	**400**	**1,000**	**10,000**
16	**8**	**20**	**40**	**80**	**160**	**320**	**800**	**8,000**

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* 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.

household or business over the last 12 months (or consult your electric bills if you save them). Ask your PV installer how much 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'll provide more information on estimating how much you will save.

- 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, and if your PV array is smaller (say 3 kilowatts), you may still end up buying the same inverter. Labor costs for a small system may be nearly as much as those for a large system. Therefore, it's worth remembering that your PV installer is likely to offer you a better price to install a 2-kilowatt system all at once, than to install a 1-kilowatt this year and another similar system next year—because multiple orders and multiple site visits are more expensive.
- 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.

How much will my PV system save me?

The value of your PV system's electricity will depend on how much you pay your utility for electricity. If your utility offers net metering (and so 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 at right to roughly approximate 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 will vary by up to 20 percent 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. Also keep in mind that you may not get full retail value for excess electricity produced by your system on an annual basis, even if your utility does offer net metering. Be sure to discuss these issues with your PV installer. Consider asking for a written estimate of the average annual energy production from the PV system. However, you should realize that even if an estimate is accurate for an average year, actual electricity production will fluctuate from year to year due to natural variations in weather and climate.

If your utility does not offer net metering, you can still use the calculation box to determine the amount of electricity your system will produce. But determining its value is much trickier because your excess electricity will not be worth as much as the electricity you actually use. You may earn only 2 cents per kilowatt-hour—or less than half of the retail rate—for your excess power. PV systems produce most of their electricity during the middle of the day when residential electric loads tend to be small. If net metering is not offered by your utility, you may want to size your system to avoid generating electricity significantly beyond your actual needs.

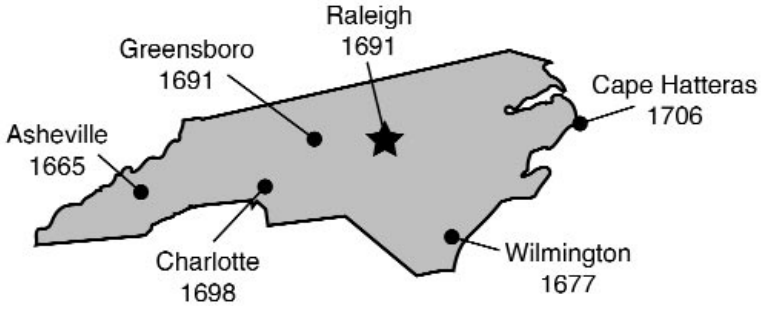
Calculating Electricity Bill Savings for a Net-Metered Grid-Tied PV System

Step 1: Select your location and kWh/kW from the map below.

Step 2: Multiply the kWh/kW-yr times the PV system rating (in kW) to get the yearly PV system production in kWh/yr.

Step 3: Multiply the PV system kWh/yr times your retail rate in $/kWh to get the annual bill savings.

Example: A 2-kW system in Raleigh, NC, at an electricity rate of $0.08/kWh, will save about $271 per year (1,691 kWh/kW-year x 2 kW x $0.08/kWh = $271/year).



Photovoltaic System Production (kWh/kW-yr)

Photovoltaic system production estimates are for a 1-kW rooftop PV system facing due south at a 20° tilt. Example: A 2-kW rooftop PV system located in Raleigh, NC, will produce about 3,382 kWh per year (2 kW x 1,691 kWh/kW-yr).

How much does a PV system cost?

There is no single answer, but keep in mind that the tax credits can reduce the cost. Your system's price will depend on a number of factors, including whether the home is under construction or whether the PV 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-kilowatt system that will offset the needs of a very energy-efficient home may cost $20,000 to $24,000 installed, or $10 to $12 per watt. At the high end, a 5-kilowatt system that will completely offset the energy needs of many conventional homes may cost $40,000 to $50,000 installed, or $8 to $10 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 installers can provide you with estimates or bids.

Are incentives available to help reduce the cost?

Yes! That's the primary focus of the solar tax credits described earlier.

How can I finance the cost of my PV system?

There is nothing magical about financing the cost of purchasing and installing your PV system. Although there are some special programs available for financing solar and other renewable-energy investments, most of the options will be familiar to you.

The best way to finance PV systems for homes is through a mortgage loan. Mortgage financing options include your primary mortgage, a second mortgage such as a U.S. Department of Housing and Urban Development (HUD) Title 1 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 financing are likely to be the most important factor in determining the effective price of your PV-generated power.

PV systems purchased for business applications are probably best financed through a company's existing sources of funds for capital purchases—usually Small Business Administration loans or conventional bank loans.

Building-integrated PV/thermal system installed on Applebee's restaurant in Salisbury, NC. (credit: Innovative Design)

Selecting a PV installer

Who sells and installs PV systems?

North Carolina is home to many reputable contractors with experience in installing PV systems.

How do you identify solar electric system installers? Here are several suggestions.

- Check the North Carolina Solar Center's Directory of Solar and Renewable Energy Resources in North Carolina, available in hard copy from the Solar Center or on the World Wide Web at:

  www-solar.mck.ncsu.edu/director.htm

- Contact regional solar equipment vendors to see if they have installers with whom they regularly work.
- Conduct a search on the Internet.

How do I choose among PV installers?

Compile a list of prospective PV installers. You might first consider those closest to you, because the contractor's travel costs might add to your system price. Next, contact these installers and find out what products and services they offer. The following questions may give you a good sense of their capabilities:

Has the company installed grid-connected PV systems? If not, has it installed grid-independent PV systems?

Experience installing grid-connected systems is valuable because some elements of the installation—particularly interconnection with the local utility—are unique to these systems. Because grid-connected systems are relatively uncommon, most contractors with PV experience have worked only on systems such as those that power remote cabins far from the nearest utility line. This means they have experience with all aspects of PV system installation except the connection with the utility grid. Although grid-connection work is different from "off-grid" work, a competent company with PV experience should not be eliminated just because it has not installed grid-connected PV systems in the past. In fact, experience with off-grid systems is valuable because grid-independent systems are more technically complicated than grid-tied systems.

How many years of experience does the company have installing photovoltaic systems?

This issue speaks for itself: A company or contractor that has been in business a long time has demonstrated an ability to work with customers and to compete effectively with other firms.

Is the company properly licensed?

PV systems should be installed by an appropriately licensed contractor. This means that either the installer or a subcontractor has an electrical contractor's license. The State Board of Examiners of Electrical Contractors, (919-733-9042) can tell you if a contracting firm has a valid license. The Board also has a Web site (www.ncbeec.org) where you can check to see if an electrical contracting firm holds a license. 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 any pending or active judgements or liens against it?

As with any project that requires a contractor, due diligence is recommended. The State Board of Examiners of Electrical Contractors, (919-733-9042) 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 Bureau can be reached at 919-872-9240 (Raleigh),or 828-253-2392 (Asheville).

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 of 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, or specify the output of the system at the inverter.

You may want to obtain some estimate of the amount of energy that the system will produce on an annual basis (measured in kilowatt-hours). 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 ±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. Many manufacturer's warranties include repair or replacement of equipment but don't cover labor for equipment removal and reinstallation. Your PV installer should provide you with a written full-system warranty that makes the installer responsible for system diagnosis, repairs, equipment removal, shipping and equipment reinstallation. Consider the length of your full-system warranty when comparing competing bids. A minimum two year full-system warranty is recommended. Also ask yourself, "Will this company stand behind the full-system warranty for the entire warranty period?"

Is the lowest price the "best deal"?

It might not be. Often, you get what you pay for. Remember that a PV company is a business just like any other, with overhead and operating expenses that must be covered. It's always possible that a low price could be a sign of inexperience. Companies that plan to stay in business must charge enough for their products and services to cover their costs, plus a fair profit margin. Therefore, price should not be your only consideration.

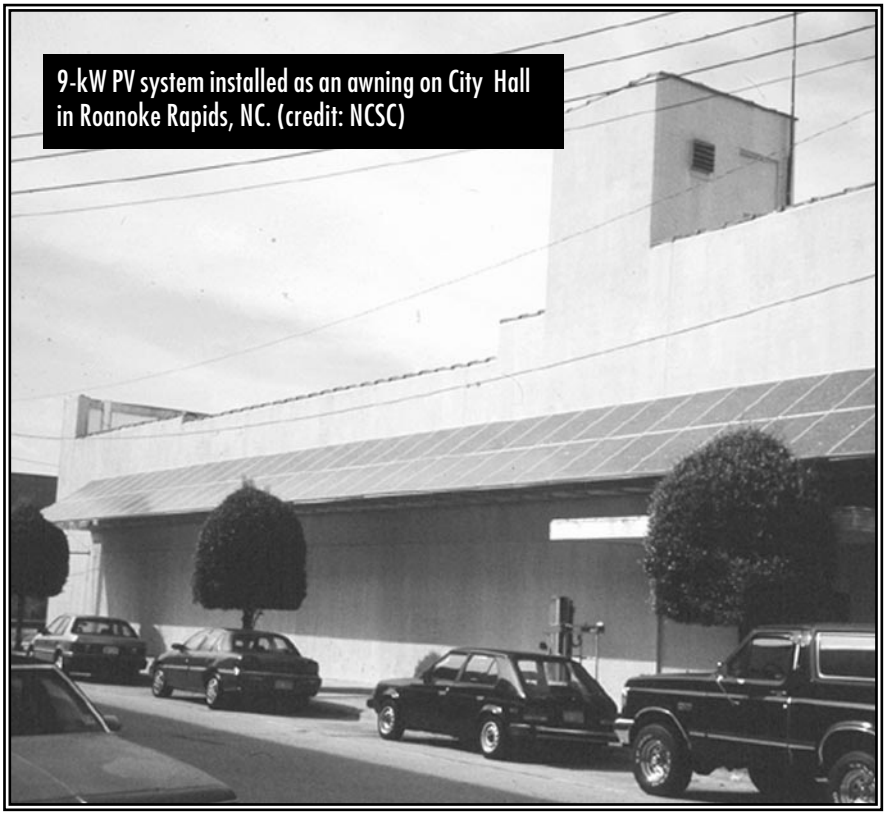
Before installing a PV system

What about permits?

If you live in a community in which a homeowners association requires approval for a solar system, you or your PV installer may need to submit your plans. Gain approval from your homeowners association before you begin installing your PV system. Under North Carolina law, you have the right to install a solar system on your home.

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 installer will take care of this, rolling the price of the permits into the overall system price. However, in some cases, your PV installer 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 installer.

Code requirements for PV systems vary somewhat from one jurisdiction to the next, but most requirements are



9-kW PV system installed as an awning on City Hall in Roanoke Rapids, NC. (credit: NCSC)

based on the National Electrical Code (NEC). The NEC has a special section, Article 690, that carefully spells out requirements for designing and installing safe, reliable, 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 installer can speed the process by working closely and cooperatively with your local building officials to help educate them about the technology and its characteristics.

What about insurance?

If you interconnect your PV system to the utility grid, 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.

How do I get an interconnection agreement?

Connecting your PV system to the utility grid will require you to enter into an interconnection agreement and a purchase and sale agreement. North Carolina Public Utilities Commission regulations and federal law require utilities to supply you with an interconnection agreement. Some North Carolina cooperative utilities ("Coops") have developed simplified, standardized interconnection agreements for small-scale PV systems.

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. The purchase and sale agreement specifies the metering arrangements, the payment for any excess generation, and any other related issues.

The language in these contracts should be simple, straightforward, and easy to understand. If you are unclear about your obligations under these agreements, you should contact the utility or your electrical service installer for clarification. If your questions are not adequately addressed, contact the NC Solar Center, which is listed under Getting Help at the end of this booklet.

National standards for utility interconnection of PV systems are quickly being adopted by many local utilities. The most important of these standards 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. Two of these standards are particularly relevant:

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

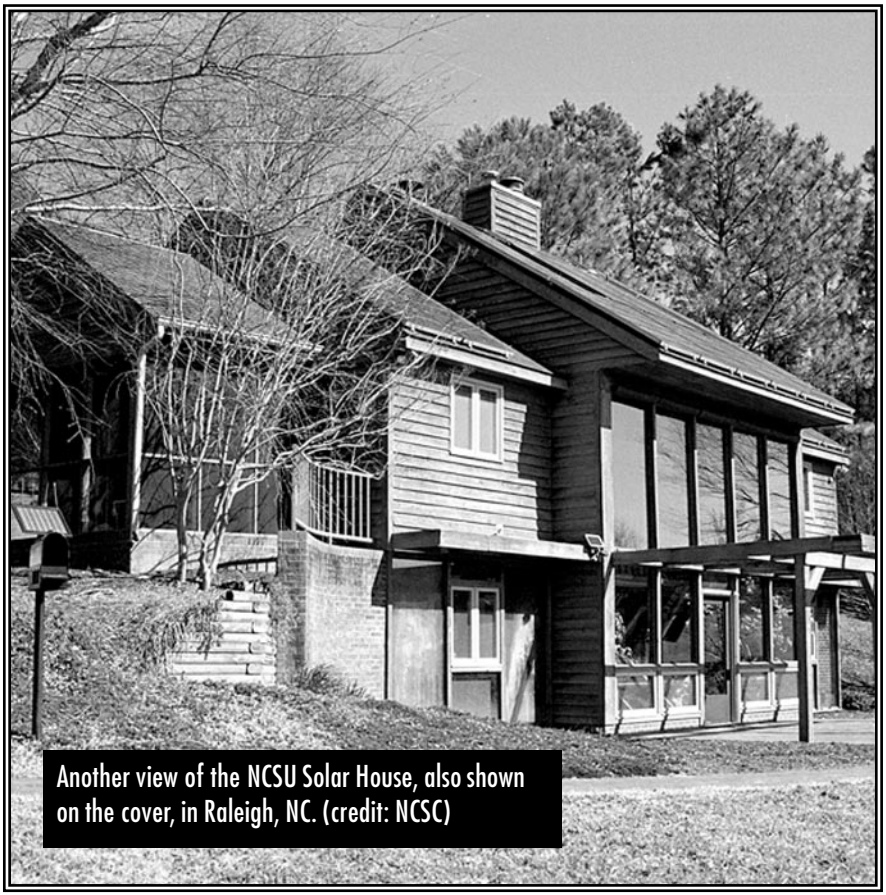
Photovoltaic Systems. Institute of Electrical and Electronic Engineers, Inc., New York, NY (1988, with revision being finalized in 1999).

- Underwriters Laboratories, UL Subject 1741: Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems. Underwriters Laboratories, Inc., Northbrook, IL (1999).

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

How do I get a net-metering agreement?

Net metering allows eligible customers with PV systems to connect to the grid with their existing single meter. Almost all standard utility meters are able to measure the flow of energy in either direction. The meter spins forward when electricity is flowing from the utility into the building and spins backward when power is flowing from the building to the utility. Net metering customers are billed monthly for the "net" energy consumed. If the customer's net consumption is negative in any month (i.e., the PV system produces more energy than the customer



Another view of the NCSU Solar House, also shown on the cover, in Raleigh, NC. (credit: NCSC)

uses), the balance is credited to subsequent months.

Net metering allows customers to get more value from the energy they generate. Net metering simplifies both the metering process (by eliminating the need for a second meter) and the accounting process (by eliminating the need for monthly payments from your utility).

Currently, North Carolina does not have a net metering law or ruling, so no North Carolina utilities are obligated to offer you a net metering agreement. Nonetheless, it is worth talking with your utility about this option.

Under the federal Public Utility Regulatory Policies Act (PURPA), utilities must allow you to interconnect your PV system, and they must also buy any excess electricity you generate (beyond what you use in your home or business). If your utility 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 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

Installation of 311-kW PV system on roof of 1996 Summer Olympics Natatorium in Atlanta, GA. (Craig Miller Productions)

electricity you generate so that it offsets electricity you would otherwise have to purchase at the retail rate. This may be a factor in how you optimize your system size, because you may want to limit the excess electricity you generate. This "dual metering" arrangement is the norm for industrial customers who generate their own power.

What 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 most likely by the electric utility with which you entered into an interconnection agreement. Inspectors may possibly require your PV installer to make corrections, but don't be alarmed—this is fairly common in the construction business.

What about warranties?

Warranties are key to ensuring that your PV system will be repaired if something should malfunction during the warranty period. A warranty should cover all parts and labor, including the cost of removing any defective component, shipping it to the manufacturer, and reinstalling the component after it is repaired or replaced. Your PV installer's full-system warranty should supercede any other warranty limitations. In other words, even if the manufacturer's own warranty on a particular component is less than two years, the PV installer should still provide you with a two-year warranty. Similarly, even if the manufacturer's warranty is a limited warranty that does not include the cost of removing, shipping, and reinstalling defective components, the PV installer should cover these costs. Note that the warranties on PV modules themselves will range from 5 to 25 years.

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.

What about system operation and maintenance?

Make sure that you have all the owner's manuals for your system components, and before your PV installer leaves once the system is installed, be sure that he or she walks you through the PV system and inverter manuals. You will save yourself (and your installer) headaches down the line if you are familiar with your system and where to look for information. Unless you have batteries, there are normally not any periodic maintenance needs for a grid-tied system, but a basic understanding of the system will serve you well in the event that there are any problems.

Getting help

To get more information on solar electric systems, please contact:

North Carolina Solar Center
Box 7401
North Carolina State University
Raleigh, NC 27695
Phone: 919-515-3480
Toll-free in NC: 1-800-33-NC SUN
Fax : 919-515-5778
E-mail: ncsun@ncsu.edu
Web: www.ncsc.ncsu.edu

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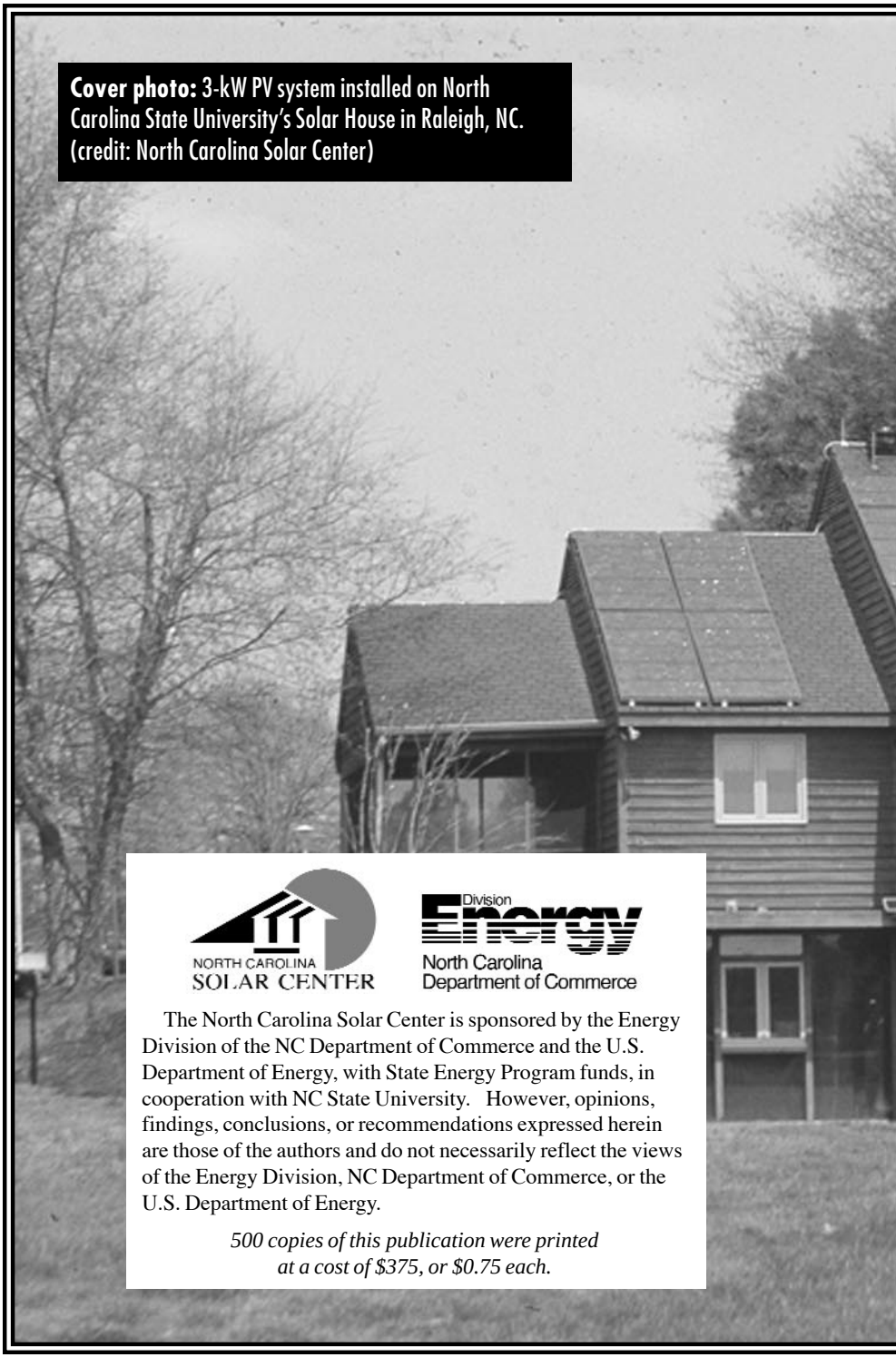

Cover photo: 3-kW PV system installed on North Carolina State University's Solar House in Raleigh, NC. (credit: North Carolina Solar Center)

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