Midwest Region Consumer's Guide to Buying a Solar Electric System

Consumers in the Midwest (Illinois, Iowa, Minnesota, Missouri, Nebraska, and Wisconsin) are showing increased interest in solar electric systems for their homes and businesses. This booklet is designed to guide consumers through the process of buying a solar electric system. Photovoltaic, or PV systems, are reliable, pollution free and use a renewable source of energy—the sun.

Aside from technological advances and cost reductions in PV technology, several state and federal PV programs and incentives are available to Midwest region customers that are making PV systems more economical than ever before. For example, several states offer financial assistance in the form of grants, tax abatements and tax credits to prospective PV customers.

The availability of net metering, which should be verified with each utility company, can also make renewable energy installation more attractive. Net metering is a practice that credits utility customers for the electricity their system generates, so that at the end of a billing period they are charged only for the "net" electricity they purchase. In most cases, a single bidirectional meter monitors only the net amount of electricity sold or purchased. In essence, the electric meter will run backward when the PV system generates more power than is being used.

A word of caution: this is not a technical guide for designing or installing a system—for that information, consumers should consider consulting an experienced PV system designer or system supplier (PV provider) 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 the right decisions are made.

These materials also provide information on PV programs, incentives and policies for states in the Midwest. As PV technology advances, this guide will be updated and provide more detailed information on state PV programs and policies.

Innovative Power Systems, Inc. /PIX09315

This home in Northfield, MN, may have an old-fashioned feel, but its 3.3-kilowatt utility-connected solar-electric shingle system gives it modern efficiency.

Contents

Background

What is a solar electric, or photovoltaic, system?

PV technology converts sunlight directly into electricity. It works during daylight hours, but more electricity will be produced when the light is more intense (a sunny day) and is striking the PV modules directly (when the rays of sunlight are perpendicular to the PV modules). Unlike solar systems for heating water, PV technology does not use the sun's heat. Instead, PV produces electricity directly from the electrons freed by the interaction of sunlight with semiconductor materials in the PV cells.

The basic building block of PV technology is the solar cell. PV cells are wired together to produce a PV module, also called a PV panel, which is the smallest PV component sold commercially. A PV system tied to the utility grid consists of one or more PV modules (array) connected to an inverter that changes the system's direct-current (DC) electricity to alternating current (AC), which is compatible with the utility grid and able to power devices such as lights, appliances, computers and televisions. Batteries may be included in the system to provide back-up power in case utilities experience power outages. Components that support the PV array, called balance-of-system, include the items in the diagram to the right.

System users do not need to understand the detailed physics of how PV works to understand its appeal: investing in PV allows users to produce their own electricity with no noise, air pollution or moving parts while using a clean, renewable resource. A PV system will never run out of fuel and it will not increase our oil imports from overseas. In fact, it may not 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.

Before deciding to buy a PV system, consumers should understand the current status of the technology:

First, PV produces power intermittently because it works only during daylight hours. This is not a problem for PV systems connected to the utility grid, because additional electricity needed by system owners is automatically delivered by their utility.

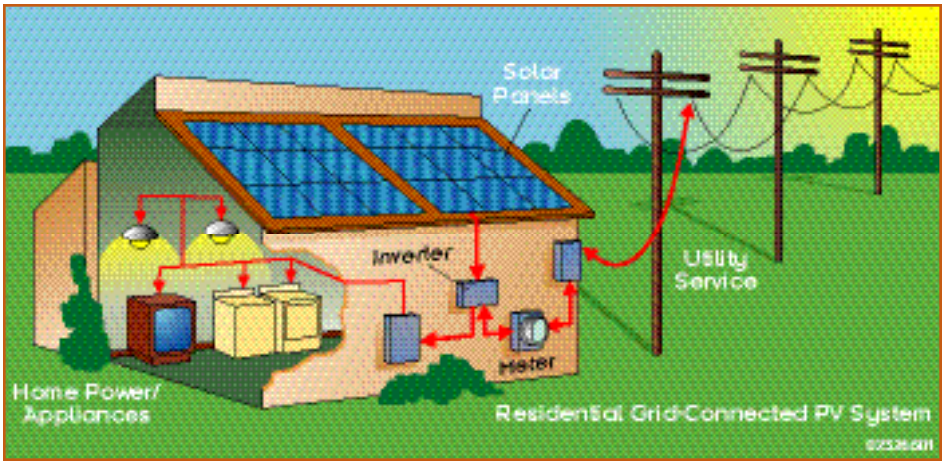
Second, PV-generated electricity is more expensive than conventional utility-supplied electricity. Improved manufacturing has reduced the cost to less than 1 percent of what it was in the 1970s, but the cost (amortized over the life of the system) can be 2–3 times higher than the kilowatt-hour (kWh) rate charged by the utilities in the Midwest region for traditional electric power. Net metering, which allows residents to spin their electric meters backwards and offset demand, can help make PV more affordable. Various incentives may also make it cost-effective.

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. System owners will probably appreciate the reduction in their monthly electric bills, but the initial expense may be significant. By financing a PV system, system costs can be spread over many years, while grants and other financial incentives can help make the cost more manageable.

Investing in a PV System

Why buy a PV system?

People decide to buy PV systems for a variety of reasons. Some want to help preserve



Solar panels convert the sun into direct-current electricity, which is converted to alternating current by the inverter for use by home appliances. This grid-connected system can either use power from or contribute power to the local utility.

Patrick Engineering/PIX09514

The solar panels on the roof of the Metcalfe Federal Building in Chicago, IL, contribute to both the building's energy supply and the campaign to make Chicago a center for green technology.

the earth's finite fossil-fuel resources and reduce air pollution. Others believe it makes sense to spend money on an energy-producing improvement to their property. Some like the security of reducing the amount of electricity bought from the utility, because it makes them less vulnerable to power outages and future increases in the price of electricity. PV systems might also make sense for rural homeowners. In cases where a house is off the grid and there are no utility lines available, PV often becomes the most economical choice for both the consumer and the utility. Finally, some people appreciate the independence that a PV system provides. Whatever the reason, solar energy is widely considered an energy source of choice for the future.

What kind of building is a good place for a PV system?

The questions below will help determine the best locations for PV systems.

Where and how should a PV system be mounted for best performance?

Usually, the best location for a PV system is a south-facing roof, but roofs that face east or west may also be acceptable. 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. An initial assessment can be made and, if the location looks promising, PV providers have the tools to trace the sun's path at a chosen location and determine whether a home or business can make use of a PV system.

The orientation of a PV system (the compass direction that the system faces) will affect performance. In the Midwest region, the sun is always in the southern half of the sky and is higher in the summer and lower in the winter. Flat roofs work well for PV systems because the modules can be mounted flat on the roof facing the sky or mounted on frames tilted toward the south at an optimal angle.

If a rooftop cannot be used, 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 multi-family or commercial applications) include mounting structures that create covered parking or provide shade as window awnings.

Is the site free from shading by trees, nearby buildings, or other obstructions?

To make the best use of a PV system, the 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 a home and the surrounding landscape. It is important to note that although 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, this shading may substantially reduce the amount of electricity that a system will produce. Existing laws in Iowa, Minnesota, Missouri, Nebraska, and Wisconsin establish rights to protect solar access through the creation of a Solar Easement. More information on solar access laws is provided in the final section of this guide (State PV Programs).

What kind of roof is on the building, 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. An experienced solar installer will know how to work on all roof types and can use roofing techniques that eliminate the possibility of leaks. PV providers should know if a PV system will affect a roof's warranty.

If the roof is older and needs to be replaced in the very near future, this may be done at the same time the PV system is installed to avoid the cost of removing and reinstalling a 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 much area is needed on a roof or property?

The amount of space needed for a PV system is based on the physical size of the system. Most residential systems require as little as 50 square feet (for a small "starter"system) up to as much as 1,000 square feet. A rule of thumb is that a square foot of single- or poly-crystalline PV module area produces 10 watts of power in bright sunlight. Therefore, a 1,000-watt system may require 80 to 300 square feet of roof area, depending on the type of PV module used. The amount of roof area needed also depends on the PV module's efficiency in converting sunlight to electricity. The table above displays typical roof-area requirements for varying PV system sizes and module efficiency figures.

PV System Area Requirements (square feet)

PV Module Efficiency (%)	PV Capacity Rating (Watts)						
	100	250	500	1000	2000	4000	10000
4	30	75	150	300	600	1200	3000
8	15	38	75	150	300	600	1500
12	10	25	50	100	200	400	1000
16	8	20	40	80	160	320	800

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.

If location limits the physical size of a system, a system that uses more efficient PV modules may be installed. Greater efficiency means 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 others. System sizing is discussed later in this booklet and should also be discussed with the PV provider.

How big should a PV system be, and what features should it have?

The first step toward designing a PV system is to analyze current electricity use in a home or business. Energy efficiency is very important when sizing a PV system. Before installing a system, it is important to make sure a home or business is as energy efficient as possible. Every kilowatt-hour that can be trimmed off the projected annual use in a PV-based system will reduce initial set-up costs. For example, a new, highly efficient refrigerator may cost $1,000 but it could avoid the need for an additional 1 kW on the PV system (which could cost $6,000–$10,000). A PV system makes most sense once all cost effective energy efficiency improvements have been made.

It is important to first determine how much of the current electricity needs will be met by the PV system. A utility can provide the building's total electricity use, measured in kilowatt-hours, over the last 12 months (or past electric bills can be reviewed if available). PV providers can determine how much electricity a new PV system will produce on an annual basis (also measured in kilowatt-hours) and compare that number to a building's annual electricity demand to get an idea of how much electricity from the utility will be offset by the system. For example, if it is determined that 50 percent of the electricity needs of a home or business should be met by the PV system, PV providers can examine past electricity consumption and determine the size of the PV system needed to achieve that goal. The next section provides more information on estimating electricity savings.

As a system is sized, it is important to consider the economies of scale that can decrease the cost per kilowatt-hour as the size of the system increases. Balance-of-

system and labor costs for a small system may be nearly as much as those for a large system. Therefore, it's worth remembering that a PV provider is likely to offer 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.

Also, it is generally not economical to try to produce more power than needed. In some states, the utility is either not required to compensate the consumer for excess generation or is only required to do so at buyback rates that are lower than retail. Typically, this is the utility's "avoided cost" rate that may be a fraction of the retail rate provided under net metering.

How much will a PV system save system owners?

The value of a PV system's electricity will depend on how much a utility is paid for electricity and how much a utility will pay for any excess that is generated. If a utility offers net metering (and pays the full retail price for excess electricity), calculations may be fairly easy because system owners and their utility will each pay the same price for each other's electricity.

A 1-kW system should meet about 12–18 percent of the typical residential customer's needs. Given the amount of solar resource available in the Midwest region, it would produce about 1,600 kWh annually under ideal conditions (i.e., south-facing installation and proper slope of the roof). If this annual power output is multiplied by the average electricity rate (approximately 7.5 cents per kWh for residential customers) and then divided by 12, electricity generated by the PV system would reduce utility bills by about $10 a month.

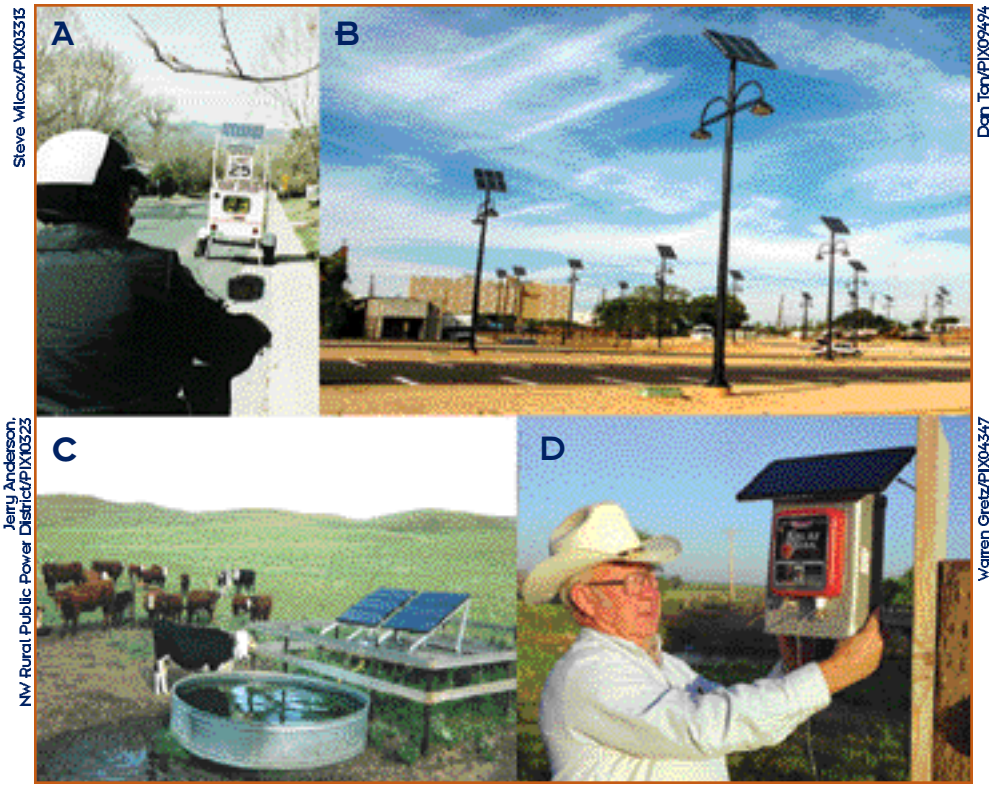
How else can PV systems be used?

Although this guide focuses primarily on PV systems that provide electricity for homes and businesses, there are many other applications for PV power. PV systems can,in many cases, be the least expensive option for applications located away from existing power lines.

PV systems can be adapted to suit any requirement, small or large. The smallest systems power calculators and wristwatches. Larger systems are used effectively worldwide to pump water for livestock, plants or humans. Since the need for water is greatest on hot sunny days, PV is a perfect fit for pumping applications. PV is also used to power remote electric fences and pond aeration. Parking and landscape lights, telecommunications equipment, highway construction signs and navigational warning signals are also excellent applications for PV.

How much does a PV system cost?

There is no single answer, but keep in mind that a solar rebate and other incentives may reduce the cost. A system's price will depend on a number of factors, including



The applications for solar electric technology are varied. A: A police officer checks a PV-powered "smart sign" to monitor traffic speed. B: PV-powered lights in a parking lot prevent the need to bury electric lines. C: PV power runs pumps for watering livestock in remote areas. D: Ranchers can rely on PV fence chargers to keep cattle from straying.

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 a system may be the most significant factor in any equation measuring costs against benefits. Small, single PV-panel systems with built-in inverters that produce about 75 watts per hour may cost around $900 installed, or $12 per watt. These small systems will offset only a small fraction of an electricity bill. A 2-kilowatt system that will offset the electricity needs in a very energy-efficient home may cost $16,000 to $20,000 installed, or $8 to $10 per watt. At the high end, a 5-kilowatt system that will completely offset the energy needs of many conventional homes may cost $30,000 to $40,000 installed, or $6 to $8 per watt. These prices are estimates and actual costs will depend on a system's configuration, equipment options and other factors. Local PV providers can provide estimates or bids.

Are incentives available to help reduce the cost?

Some states offer programs or incentives to help "buy down"the cost of a PV system or make it easier to finance. These incentives may include: tax abatements, tax credits, state grants and low-interest financing packages. The final section of this booklet ("State Programs") provides the most up-to-date information on incentives and financing options for PV systems.

If a home is used for a business, system owners may be able to take advantage of federal financial support for PV technology through a tax credit for commercial uses of solar energy. This business energy tax credit provides businesses (but not individuals or utilities) with a 10 percent tax credit and 5-year accelerated depreciation for the cost of equipment used to generate electricity by solar technologies. These tax benefits can substantially reduce the effective cost of a PV system and should be thoroughly investigated. More information can be found on the Internet at *www.dsireusa.org*.

WI Public Service Community Foundation SolarWise for Schools /PIX07631

Workers install solar-electric panels on the De Pere High School as part of Wisconsin's SolarWise for Schools program.

How can a PV system be financed?

Although there are some special programs available for financing solar and other renewable energy investments, most options will be familiar to consumers.

One of the best ways to finance PV systems for homes is through a mortgage loan. Mortgage financing options include primary mortgages, 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 a 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 for federal tax purposes (subject to certain conditions). If a PV system is bought at the same time that a house is built, purchased or refinanced, adding the cost of the PV system to the mortgage loan is likely to be relatively simple and may avoid additional loan application forms or fees.

If mortgage financing is not available, people should look for other sources of financing, such as conventional bank loans. Because a PV system is a long-term investment, the terms and conditions of PV financing are likely to be the most important factor in determining the effective price of 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.

Selecting a PV Provider

Who sells and installs PV systems?

Most consumers will need to select a vendor to install their PV system. In some locations, finding a PV provider or installer can be as simple as picking up the telephone directory and looking under "Solar Energy Equipment and Systems—Dealers." However, many of those listings are for solar water-heating companies, which may not be experienced in PV system design or installation. Similarly, many electrical contractors, although proficient in typical electrical contracting work,may not have expertise in PV or with residential roof-mounting techniques. In the Midwest, prospective customers may check the following for PV system installers and designers:

- "Midwest PV Yellow Pages," available from the Iowa Department of Natural Resources Energy and Waste Management Bureau, by calling 515-281-7018 or by visiting *www.state.ia.us/dnr/energy/programs/solar*.
- Contact the utility company to see which vendors it might recommend.
- Contact a local solar energy organization for vendor recommendation.
- Conduct a search on the Internet.

How should consumers choose among PV providers?

First, compile a list of prospective PV providers. People should first consider those closest to them, because the contractor's travel costs might add to system price. Next, the providers should be contacted to find out what products and services they offer. The following questions may give consumers a good sense of a PV provider's 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 still 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 PV systems?

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?

An appropriately licensed contractor should install PV systems. This usually means either the installer or a subcontractor has an electrical contractor's license. The appropriate state agency should be contacted to verify that a given contractor is licensed to perform the installation. 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.

Several programs and organizations, including the Department of Energy's Million Solar Roof Initiative, the Midwest Renewable Energy Association and the Interstate Renewable Energy Council, are working to develop a national training program for solar energy system installation and maintenance and a certification process for installers that will meet national standards. The North America Board of Certified Energy Practitioners (NABCEP) also is in the process of creating a certification program for installers of photovoltaic systems. The NABCEP program is intended to be a voluntary national certification recognized throughout the United States.

Does the company have any pending or active judgments or liens against it?

As with any project that requires a contractor, due diligence is recommended. Each state's Electrical Board can inform consumers about any judgments or complaints against a state-licensed electrician. Con-

This nature center near Cedar Rapids, IA, uses solar electricity to run low-wattage, energy-efficient lights.

sumers should call the city and county in which they live for additional information on how to check on contractors. The Better Business Bureau is another source of information on contractors.

How do consumers choose among competing bids?

If there are several bids for the installation of a PV system (and it's generally a good idea to obtain multiple bids), consumers should take steps to ensure that all of the bids received 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, the bids should specify the system capacity in AC watts, or specify the output of the system at the inverter.

Consumers 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 percent is more realistic. Bids also should include the total cost of getting the PV system operational, including hardware, installation,connection to the grid, permitting, sales tax and warranty.

What about warranties?

A warranty is a very important factor for evaluating bids. Warranties are key to ensuring that a PV system will be repaired if something should malfunction during the warranty period. PV systems should carry a full (not "limited") two-year warranty, in addition to any manufacturers' warranties on specific components. This 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. Consumers need to know who is responsible for honoring the various warranties associated with a system—the installer, the dealer, or the manufacturer. The vendor should disclose the warranty responsibility of each party. Consumers should also know the financial arrangements, such as contractor's bonds, that assure the warranty will be honored. A warranty does not guarantee that the company will remain in business. It is important to know whom to contact if there is a problem. To avoid any later misunderstandings, warranties should be read carefully, including a full review of the terms and conditions with the retailer.

Is the lowest price the "best deal"?

It might not be. 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 products and services to cover their costs, plus a fair profit margin. Therefore, price should not be the only consideration.

If a state has an incentive program for solar energy, it may be through a pre-selected group of contractors. If so, consumers can only get the incentive by using one of those contractors. Furthermore, most state programs require the prospective PV customer to first contact the state to apply to the grant program and verify that incentives are still available. A customer should not expect to receive incentives or grants

after they have installed a system on their own. It is important for customers to contact the state before proceeding with a solar project.

Installing a PV System

What about permits?

Some communities have a homeowners' association that might require approval for a solar system. System owners or the PV provider may need to submit plans and should gain approval from the homeowners'association before installation of the PV system begins.

Most likely, permits from the city or county building department will need to be obtained. A building permit,an electrical permit or both might be required before installing a PV system. Typically, a PV provider will take care of this, rolling the price of the permits into the overall system price. However, in some cases, a 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, permitting costs and responsibilities should be addressed at the start with a PV provider.

A variety of organizations have worked with the PV industry in the development of various codes and standards. Code requirements for PV systems vary somewhat from one jurisdiction to the next, but most requirements are based on the National Electrical Code (NEC). The NEC has a special section, Article 690, which carefully spells out requirements for designing and installing safe, reliable, code-compliant PV systems. Because most local requirements are based on the NEC, building inspectors are likely to rely on Article 690 for guidance in determining whether a PV system has been properly designed and installed. If a PV system is among the first in a community to be installed and is grid-connected, the local building department may not have approved one of these systems. If this is the case, system owners and their PV provider can speed up the process by working closely and cooperatively with local building officials to help educate them about the technology and its characteristics. Other standards are in place to prove the safety and operation of PV system components. Two of these standards, Underwriters Laboratories and Institute of Electrical and Electronic Engineers, are discussed later in this guide.

Missouri Botanical Garden/PIX10352

This Victorian home in St. Louis, MO, demonstrates the practical use of energy-efficient systems, including a 1.5-kilowatt solar-electric unit that powers all the kitchen appliances.

What about inspector and utility sign-off?

After a new PV system is installed, it may need to be inspected and "signed off" by the local permitting agency (usually a building or electrical inspector) and perhaps by the electric utility. Inspectors may require the PV provider to make corrections. This is fairly common in the construction business.

What about insurance?

If a PV system is bought for a home, a standard homeowner's insurance policy is usually adequate to meet the utility's requirements. However, system owners may wish to contact their insurance carrier or one of the groups listed in the final section of this booklet. In some states, the electric utility may require additional insurance.

Connecting a PV System to the Grid

Is connecting to the grid necessary?

The conditions of an individual site determine whether or not a system should be grid-connected.

"Off-grid" means operating the PV system independently of the utility grid. In cases where a house has no electricity and no utility lines are available, PV often becomes an economical choice for both the consumer and the utility. The cost of running a special line more than one-quarter mile can be higher than the cost of installing a PV system.

If a PV system is designed to meet only a portion of the electricity load, the system will need to be interconnected with the local utility to meet the remainder of the user's electricity needs. There are two ways that PV systems can be wired for residential homes: grid-connected and grid-connected with battery storage. Grid-connected means the PV system interfaces directly with a current utility connection. This set-up allows the consumer generator to put excess generation (when PV generation exceeds consumption) back to the grid. However, if there is a utility power outage, the system will only produce electricity if there is enough solar resource available (i.e.,during daylight hours). Grid-connected with battery storage avoids this situation. The included battery system provides back-up power in case of a utility power outage. Batteries add value to a system, but at an increased price.

If a system needs to be grid-connected, interconnection is key to the safety of both the customer and the utility lineworkers and to the protection of equipment.

How does the PV system interface with an existing utility connection?

In times when consumption exceeds generation by the PV system, the consumer simply obtains the additional power from the local utility as always. Grid-connected systems are gaining in popularity because they do not require battery storage and are more efficient in converting solar energy to electricity. Provided the utility allows net metering, grid-connected systems also tend to be the most cost effective. Under net metering, customers receive credit for excess electricity from their PV systems. In essence, the electric meter will run backward when the user is not consuming all the power the PV system generates (see following discussion). Several Midwest states offer net metering, although the terms and conditions vary in each case.

Utilities should be contacted well in advance to establish terms and conditions for interconnection requirements and net metering information before purchasing and installing a PV system.

How do system owners get an interconnection agreement?

Connecting a PV system to the utility grid will require entering into an interconnection agreement and a purchase and sale agreement. Some state utilities commissions and federal law require utility companies to supply an interconnection agreement. Some utilities have developed simplified, standardized interconnection agreements for small-scale PV systems.

The interconnection agreement specifies the terms and conditions under which a system will be connected to the utility grid. These may include obligations 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 obligations are unclear under these agreements, the utility or electrical service provider should be contacted for clarification. If questions are not adequately addressed, consumers should contact the proper state regulatory groups listed at the end of this booklet.

National standards for utility interconnection of PV systems are 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 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 (finalized in 2000). More information can be found on the Internet at *www.ieee.org*.

- Underwriters Laboratories, UL Subject 1741: Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems (First Edition). Underwriters Laboratories, Inc., Northbrook, IL (December 1997). More information can be found on the Internet at *www.ul.com*.

Underwriters Laboratories (UL) has worked closely with the PV industry to help develop standardized tests to prove the safety of PV modules and inverters.

The Institute of Electrical and Electronic Engineers (IEEE) Standards Board approved the Interconnection Standard (IEEE 929-2000 Recommended Practice for Utility Interface of Photovoltaic (PV) Systems) on January 30, 2000. It provides a standard that PV interconnection hardware can be designed to, thus removing a costly situation where different utility jurisdictions require specialized hardware. The IEEE standard applies to the PV inverter, the device that converts the PV system's DC energy into utility-compatible AC energy. An important parallel effort was performed at Underwriters Laboratories, where a test procedure, UL 1741, was written that will verify that an inverter meets the requirements of IEEE 929.

It is a system owner's obligation to ensure that their PV provider uses equipment that complies with the relevant standards. Interconnection should be discussed with the utility and their requirements should be clarified before purchasing any equipment. Utilities are responsible for maintaining the safety and reliability of the grid and have legitimate concerns about the interconnection of outside systems to the network.

MSB Energy Associates/PIX10520

In the High Wind Association, a Wisconsin community that practices sustainable living, homes use solar electricity. Each system is connected to the local electric utility, which has a net metering agreement with homeowners.

What about net metering?

Net metering has been generally accepted as a way for states to encourage consumers to purchase renewable energy systems. Basically, net metering allows customers to only pay for their "net"electricity, or the amount of power consumed from the utility minus the power generated at the customer's home via the renewable energy system. Excess generation (power not consumed during the billing period) may be reimbursed at the utility's avoided cost (usually a much lower rate) or not at all. Once the utility has been contacted and has cleared a PV system for net metering, system owners should verify they are receiving credit. If the renewable energy system is generating more electricity than is being used in the building, the electric meter should be spinning in reverse. In most circumstances, the "old fashioned" meter with mechanical dials works fine. However, some newer electronic meters have trouble registering electricity flow in reverse. PV installers should know if there would be a problem with the meter.

Appendix: National, Regional, and State PV Programs, Incentives, and Contacts

National PV Programs

Borrower's Guide to Financing Solar Energy Systems

www.millionsolarroofs.org/financing_otherresources

Provides information for lenders and consumers about nationwide financing programs for photovoltaic systems and solar thermal systems that heat indoor air and water. In addition to traditional sources for home mortgage funds, eight federal government organizations—Fannie Mae, Freddie Mac, U.S. Department of Agriculture, U.S Department of Energy, U.S. Department of Housing and Urban Development, U.S. Department of Veterans Affairs, U.S. Environmental Protection Agency and U.S. Small Business Administration offer programs for financing solar energy systems and other energy efficiency improvements.

Database of State Incentives

www.dsireusa.org

Database of State Incentives for Renewable Energy (DSIRE), is a comprehensive source of information on the status of programs and incentives that promote renewable energy. The database tracks information on financial incentives, regulatory policies and awareness and investment programs. DSIRE is an ongoing project of the Interstate Renewable Energy Council (IREC), funded by the U.S. Department of Energy's Office of Power Technologies and managed by the North Carolina Solar Center.

For more information, contact:
North Carolina Solar Center
Box 7401
North Carolina State University
Raleigh, NC 27695-7401
919-515-5666
ncsun@ncsu.edu

U.S. Department of Energy's Million Solar Roofs Program

www.millionsolarroofs.org

The Million Solar Roofs Initiative (MSRI) is enabling businesses and communities to install solar systems on one million rooftops across the United States by 2010. The U.S. Department of Energy is leading this initiative by working with partners in the building industry, local governments, state agencies, the solar industry, electric service providers and non-governmental organizations to remove barriers and strengthen the demand for solar technologies.

For more information, contact:
Chicago Regional Office (IL, IN, IA, MI, MN, MO, OH, WI)
Bill Hui
One South Wacker Drive, Suite 2380
Chicago, IL 60606-4616
312-886-8586
William.Hui@ee.doe.gov

Interstate Renewable Energy Council

www.irecusa.org

The Interstate Renewable Energy Council's (IREC) mission is to accelerate the sustainable use of renewable energy in and through state, local government, and community activities.

IREC supports market-oriented services targeted at education, coordination, procurement, the adoption and implementation of uniform guidelines and standards, and consumer protection. IREC was formed in 1980 as a non-profit organization. IREC's members include state energy offices, city energy offices, other municipal and state agencies, national laboratories, solar and renewable organizations and companies, and individual members. IREC works with many partners including the federal government, national environmental and municipal organizations, regulatory commissions, state-appointed consumer representatives, energy service providers, utility groups, universities, and research institutes. IREC focuses on some of the current and often difficult issues impacting expanded renewable energy use such as rules that support renewable energy and distributed resources in a restructured market, connecting small-scale renewables to the utility grid, developing quality credentials that indicate a level of knowledge and skills competency for renewable energy professionals, and getting the right information to the right people.

For more information, contact:
IREC
P.O. Box 1156
Latham, NY 12110-1156
518-458-6059 (phone and fax)
info@irecusa.org

National Renewable Energy Laborator y

www.nrel.gov/clean_energy/photovoltaic.html

The National Renewable Energy Laboratory's (NREL) mission is to develop renewable energy and energy efficiency technologies and practices, advance related science and engineering and transfer knowledge and innovations to address the nation's energy and environmental goals. Almost 50 areas of scientific investigation include basic energy research, photovoltaics, wind energy, building technologies, advanced vehicle technologies, solar thermal electric, hydrogen, superconductivity, geothermal power, and distributed energy resources.

National Center for Photovoltaics

www.nrel.gov/ncpv

The Center's mission is to mobilize national (U.S.) resources in photovoltaics by performing world-class research and development, promoting partnering and growth opportunities, and serving as a forum and information source for the photovoltaics community. The Center is headquartered at the National Renewable Energy Laboratory in Golden, Colorado, but it is located wherever its members do business.

The Center also helps people come together to work with its researchers and one another to find ways to expand PV applications. The Center brings people together through conferences and forums to share information and concerns and the Center provides various forms of information for people with a wide range of needs.

For more information, contact:
National Renewable Energy Laboratory
1617 Cole Blvd
Golden, CO 80401-3393
303-275-3000

Sandia National Laboratories Renewable Energy Technologies Office

www.sandia.gov/pv

The purpose of Sandia's Photovoltaics Program is to develop commercially viable energy technologies based on solar, wind and geothermal resources that become significant domestic and international energy supplies, with a primary focus on the utility sector.

Sandia's Photovoltaic Program seeks to lower the cost, increase the reliability and improve the performance of photovoltaic systems. These goals can be achieved through focused research and systems development, integrated with the needs of manufacturers and users. Specific program objectives include reducing the life cycle cost of PV systems, reducing barriers to systems acceptance, providing systems engineering best practices and guidelines, and leading the national effort in performance and reliability testing, standardization, and validation.

For more information, contact:
Sandia National Laboratories, New Mexico
PO Box 5800
Albuquerque, NM 87185

or

Sandia National Laboratories, California
PO Box 969
Livermore, CA 94551

Solar Electric Power Association

www.solarelectricpower.org

The Solar Electric Power Association (SEPA), formerly the Utility Photovoltaic Utility Group, is a nonprofit association of nearly 100 energy service providers (electric utilities and energy service companies) dedicated to accelerating the use of photovoltaics for the benefit of electric utilities and their customers so that photovoltaics become a sustainable energy option and a thriving domestic industry. SEPA, with funding support from DOE, is led and managed by the market itself—the potential utility buyers of solar photovoltaic systems. SEPA programs are increasing the experience of electric utilities and their customers with photovoltaics and are stimulating growth in the demand for solar power.

Midwest PV Programs

Regional Chapters of the American Solar Energy Society

www.ases.org

The American Solar Energy Society (ASES) is a national organization dedicated to advancing the use of solar energy for the benefit of U.S. citizens and the global environment. ASES promotes the widespread use of solar energy. ASES sponsors the National Solar Energy Conference and Issue Roundtables, publishes "Solar Today" magazine, distributes solar publications, organizes a Solar Action Network, and has regional chapters throughout the country. The following is a list of Midwest ASES chapters:

- ***Heartland Renewable Energy Society (KS, MO)***
  www.heartland-res.org
  12 NW 38th Street
  Kansas City, MO 64116
  816-454-6321
  d.pratt@planetkc.com

- ***Illinois Solar Energy Association***
  www.anet-chi.com/~ISEA
  1264 Harvest Court
  Naperville, IL 60564
  630-420-1118
  casazeus2@aol.com

- ***Minnesota Renewable Energy Society***
  www.freenet.msp.mn.us/org/mres
  c/o IPS, Inc.
  1153 16th Avenue, SE
  Minneapolis, MN 55414
  651-647-0070

Environmental Law and Policy Center

www.elpc.org

The Environmental Law and Policy Center (ELPC) is a Midwest public interest environmental advocacy organization working to achieve cleaner energy resources and implement sustainable energy strategies, promote innovative and efficient transportation and land use approaches that produce cleaner air and more jobs, and develop sound environmental management practices that conserve natural resources and improve the quality of life in communities. One of ELPC's premises is that environmental progress and economic development can be achieved together.

For more information, contact:
Environmental Law and Policy Center
35 East Wacker Drive #1300
Chicago, IL 60601 USA
312-673-6500

Midwest Renewable Energy Association

www.the-mrea.org

Founded in 1990, the Midwest Renewable Energy Association (MREA) is a network for sharing ideas, resources and information to promote a sustainable future through renewable energy and energy efficiency. In 1996, MREA became a chapter of the American Solar Energy Society. The MREA currently has more than 2,018 active members from around the world representing 40 states and four foreign countries.

For more information, contact:
Midwest Renewable Energy Association
7558 Deer Road
Custer, WI 54423
715-592-6595
info@the-mrea.org

Regional Chapters of the Solar Energy Industries Association

www.seia.org

The Solar Energy Industries Association (SEIA) is the national trade association of solar energy manufacturers, dealers, distributors, contractors, and installers. SEIA's primary mission is to expand the use of solar technologies in the global marketplace. National members, combined with chapter members in 22 states, exceed 500 companies providing solar thermal and solar electric products and services. The following is a list of Midwest SEIA chapters:

- ***Great Lakes SEIA (IL, IN, MI, MN, OH, WI)***
  c/o Solar Works in Michigan
  P.O. Box 414
  Tustin, MI 49688-0414
  616-636-4995
  solarworks@wingsisp.com

- ***Heartland SEIA (IA, KS, MO, NE)***
  www.solarguide.com
  13700 West 108th Street
  Lenexa, KS 66215
  913-338-1939
  solarbeacon@msn.com

- ***WisconSUN***
  www.wisconsun.org

  WisconSUN promotes solar energy projects by marketing, reducing barriers and helping participants. WisconSUN supports projects during planning, design and installation. They also provide the information, training and project manage ment assistance needed to implement these systems successfully.

  For more information, contact:
  WisconSUN
  7507 Hubbard Ave., Suite 200
  Middleton, WI 53562
  608-831-1127 x308

State PV Programs

The following is a list of programs, contacts and incentives specific to each Midwest state in this guide. For a more complete list, please visit the "Database of State Incentives for Renewable Energy (DSIRE)," a comprehensive source of information on the status of programs and incentives that promote renewable energy. The database tracks information on financial incentives, regulatory policies and awareness and investment programs and is accessible online at *www.dsire.org*. DSIRE is an ongoing project of the Interstate Renewable Energy Council (IREC), funded by the U.S. Department of Energy's Office of Power Technologies and managed by the North Carolina Solar Center.

Illinois

Financial Incentives and Programs

Property Tax Special Assessment for Renewable Energy Systems

This statute allows for a special assessment of solar energy systems for property tax purposes. Eligible equipment includes active and passive systems, as well as wind and geothermal systems. Contact the Illinois Department of Commerce and Community Affairs for more information.

Alternative Energy Bond Fund Program

This grant program funds capital projects of any renewable energy technology up to 100 percent of the total project cost. Grants range from $60,000 to $1,000,000, and current appropriations for the program are $5 million. Note that this fund is not available for residential projects. The Bureau of Energy and Recycling under the Illinois Department of Commerce and Community Affairs administers the program.

Renewable Energy Resources Program Grants and Rebates

The Renewable Energy Resources Program (RERP) fosters investment in and the development and use of renewable energy resources within the state of Illinois. RERP distributes funds in the form of grants (for large systems) and rebates (for small systems). Grant funds may only be used for actual equipment and installation expenses. Eligible applicants include associations, individuals, private companies, public and private schools, colleges and universities, non-profit organizations, and units of state and local government. Applications are accepted on an ongoing basis. Contact the Illinois Department of Commerce and Community Affairs for more information.

Net Metering

In April 2000, Commonwealth Edison (ComEd), the investor-owned utility serving the city of Chicago and surrounding areas, established a special billing program that allows for net metering of photovoltaic and wind energy systems up to 40 kW. The program is available to all customer classes in the ComEd service area, with the total installed generating capacity not to exceed 0.1 percent of the utility's annual peak demand.

ComEd will pay the customer, on a monthly basis, the utility's avoided costs for any net excess generation. In addition, as an incentive for customers to participate in the program, ComEd will make an annual payment for the customer's total excess power put back into ComEd's system during the year (up to the amount of power the customer took from ComEd during the year). Customers will be paid at a rate representing the difference between the average avoided cost paid to the customer and the average retail rate paid by the customer during the year. Visit ComEd's Web site at *www.ucm.com/comed* for more information, or contact:

Exelon Corporation
ComEd Energy
ESO Tech.Services, 2nd Fl (02-NE-025)
Three Lincoln Centre
Oakbrook Terrace, IL 60181-4260
630-576-6783

Interconnection

Illinois has not enacted any statewide requirements for interconnection of renewable energy systems, other than standards established under the federal PURPA law. Commonwealth Edison's net metering agreement specifies that generating facilities must use an inverter listed per UL 1741. It also requires systems over 25 kilowatts to be inspected and tested by ComEd to its satisfaction. Commonwealth Edison has developed a relatively simple, user-friendly, five-page interconnection agreement for customers participating in its net metering program. Contact ComEd (see above address) for more information.

Illinois Contacts

Illinois Department of Commerce and Community Affairs Bureau of Energy and Recycling

www.commerce.state.il.us/com/energy/index.html

The Renewable Energy Resources Program is administered through the Illinois Department of Commerce and Community Affairs' (DCCA) Bureau of Energy and Recycling. The Renewable Energy Resources program fosters investment in and the development and use of renewable energy resources within the state of Illinois. This program provides rebate and grant funding for projects that increase the use of alternative energy technologies in Illinois.

For more information, contact:
Illinois Department of Commerce and Community Affairs
Bureau of Energy and Recycling
620 East Adams Street
Springfield, Illinois 62701
217-557-1925

Illinois Commerce Commission

www.icc.state.il.us

The Illinois Commerce Commission is the state's Public Utility Commission. In an age of diminishing economic regulation, the agency still holds authority in the public

interest to oversee several financial and service aspects of investor-owned electric, gas, telephone, water, and sewer utilities.

For more information, contact:
IL Commerce Commission
527 E.Capitol Avenue
Springfield, IL 62701
800-524-0795

Illinois Renewable Energy Association
www.illinoisrenew.org

The Illinois Renewable Energy Association's (IREA) mission is to be a network for sharing ideas, resources and information with individuals, businesses and communities to promote a resilient future through renewable energy, energy efficiency, and earth-friendly technology.

For more information, contact:
Illinois Renewable Energy Association
1230 E.Honey Creek Road
Oregon, IL 61061
815-732-7332

Iowa

Financial Incentives and Programs

Iowa Property Tax Exemption for Solar Systems
According to Iowa Code, Chapter 441.21, when assessing property for tax purposes, assessors shall disregard any market value added by a solar energy system to a building for the first five full assessment years. Solar energy systems are defined as follows: any system capable of collecting and converting solar radiation into thermal, mechanical or electric energy, or a system that utilizes the basic building design to maximize solar heat gain in the cold season and minimize solar heat gain in the hot season. For more information, contact the Iowa Department of Natural Resources Energy and Waste Management Bureau.

Iowa Energy Bank
www.state.ia.us/dnr/energy/programs/bem/ebank

The Iowa Energy Bank, an energy management program using energy cost savings to repay financing for energy management improvements, targets public and non-profit facilities (public schools, hospitals, private colleges, private schools, and local governments). The Iowa Energy Bank starts with an initial energy audit and helps manage the energy efficiency improvements and financing process every step of the way. Experts will customize solutions that meet the specific needs of an organization, with the assurance of high technical quality and the potential for attractive cost savings. Financing is provided through area lending institutions that create budget-neutral, affordable financial packages. For more information, contact the Iowa Department of Natural Resources Energy and Waste Management Bureau.

Solar Access Easement
Iowa's solar easement provisions allow property owners to create binding solar easements for the purpose of protecting and maintaining proper access to sunlight. For more information, contact the Iowa Department of Natural Resources Energy and Waste Management Bureau.

Alternate Energy Revolving Loan Program
www.energy.iastate.edu/about/grantloan/AERLP

The Alternate Energy Revolving Loan Program (AERLP) is administered by the Iowa Energy Center at Iowa State University and funded by the state's investor-owned utilities. The AERLP provides loans to any individual or organization that wants to build renewable energy production facilities in Iowa. Renewable energy includes technologies such as solar, biomass, wind, and hydro. Successful applicants receive a single, low-interest loan that consists of a combination of AERLP funds and lender-provided funds. The AERLP provides 50 percent of the total loan, up to a maximum of $250,000 at zero percent interest. The remainder of the loan is made by a lender at a negotiated interest rate. The maximum loan term allowed for the AERLP funds is 20 years. The borrower does not need to be an Iowa citizen but the alternate energy production facility (AEPF) must be physically located in Iowa. For more information, contact the Iowa Energy Center.

Net Metering
Created by the Iowa Utilities Board in 1983, Iowa's net metering rule allows customers with alternative energy generation systems to sell electricity to their investor-owned utilities on a netted basis against their metered retail use. The rule applies to all customer classes and requires that customers' net excess generation be purchased by the utilities at their avoided cost. For more information on Iowa's net metering rules, contact the Iowa Utilities Board.

Interconnection
Under Chapter 15.4(2) of the Iowa Administrative Code, electric utilities are required to interconnect with any qualifying facility as necessary. Contact the Iowa Utilities Board for more information.

Iowa Contacts

Iowa Department of Natural Resources Energy and Waste Management Bureau
www.state.ia.us/dnr/energy

The Energy and Waste Management Bureau is the state of Iowa's core agency for creating policies and programs that decrease its reliance on imported fossil fuels. This goal is accomplished by promoting energy efficiency and the use of renewable energy resources. Through a wide array of educational, financial and marketing programs, the Bureau is working to leverage new opportunities that save money, increase profits and improve the environment.

For more information, contact:
Iowa Department of Natural Resources
Energy and Waste Management Bureau
Wallace State Office Building
502 E 9th St
Des Moines, IA 50319-0034
515-281-5918

Iowa Utilities Board
www.state.ia.us/government/com/util

The Utilities Board regulates certain electric, natural gas, telephone and water utilities in Iowa. The most visible of the Board's activities are the approval of rate levels and review of service quality. Other important activities include the approval and monitoring of utility energy efficiency plans, administration of the Dual Party Relay System and intervention in federal regulatory cases affecting Iowa customers. The Board and staff directly assist customers by providing information and investigating complaints. Staff specialists perform audits, analyses and research,and advise the Board on pending cases. Staff also conduct continuing inspections of utilities' facilities for compliance with safety and service quality.

For more information, contact:
Iowa Utilities Board
350 Maple Street
Des Moines, IA 50319-0069
515-281-3839 or
877-565-4450

Iowa Energy Center
www.energy.iastate.edu

The Iowa Energy Center works to improve Iowa's economy and environment by helping Iowans use energy wisely. The Energy Center conducts and sponsors research regarding alternate energy and energy efficiency;educates with training, demonstrations, publications, Internet and speaking engagements; and offers low-cost financing through the Alternate Energy Revolving Loan Program that encourages construction of renewable energy projects in Iowa.

For more information, contact:
Iowa Energy Center
2521 Elwood Drive, Suite 124
Ames, IA 50010-8229
515-294-8819
iec@energy.iastate.edu

Iowa Renewable Energy Association
www.irenew.org

I-RENEW is a non-profit organization dedicated to promoting the use of renewable energy and energy conservation in Iowa. I-RENEW sponsors practical educational activities designed to reach individuals, farms, businesses, schools and utilities, while also encouraging retail opportunities. I-RENEW's educational and promotional activities include the "Iowa Sustainable Energy Sourcebook," a resource directory of individuals, businesses, researchers, organizations and suppliers in all fields of renewable energy;a quarterly newsletter offering renewables information and networking opportunities; and tours of renewable energy and energy efficiency sites in Iowa.

For more information, contact:
I-RENEW
P.O. Box 355
Muscatine, IA 52761-0355
563-288-2552
irenew@irenew.org

Minnesota

Financial Incentives and Programs

Wind and Photovoltaic Systems Exemption
This statute excludes from property taxation the value added by photovoltaic and certain wind energy systems. This statute applies to the residential, commercial, and utility sectors.

PV Sales Tax Exemption
Energy-efficient products, including photovoltaic panels, were exempted from the state sales tax as part of legislation signed by the Governor of Minnesota in July 2001. The exemption is effective for sales and purchases made after July 31, 2001, and before August 1, 2005. For more information on the Wind and Photovoltaic Systems Exemption, contact the Minnesota Department of Commerce State Energy Office.

PV Rebate Program
The Minnesota Department of Commerce will be administering a PV rebate program for commercial and residential sectors to buy down the upfront costs of grid-connected PV systems by $2,000/kW

(1-4 kW systems are eligible, based on the combined DC rating of panels). Rebates are initially available to any non-utilities and small businesses in Xcel Energy's service territory in 2002, any non-utility in Xcel Energy's Service Territory in 2003 and any non-utility in Minnesota in 2004 and 2005, funding permitting. For more information on the PV Rebate Program, contact the Minnesota Department of Commerce State Energy Office.

Solar and Wind Easements

Minnesota statutes provide for the creation of easements for solar and wind energy devices. As in many other states, these easements are voluntary contracts. The statute also notes that for tax purposes, an easement imposed on a property may decrease the property value, but an easement that benefits a property may not add value to that property.

Minnesota statutes also allow local zoning boards to restrict development for the purposes of protecting access to sunlight. Subdivisions may create variances in zoning rules in situations where undue hardships—such as lack of access to sunlight for solar energy devices—impinge on a particular property. Contact the Minnesota Department of Commerce Energy Division for more information.

Net Metering

For net metered photovoltaic systems under 40 kW in size, all Minnesota utilities use a two-page standard contract in addition to a set of interconnection requirements, both of which are available from your local utility.

Interconnection

As part of the 2001 Omnibus Energy Bill, the Minnesota legislature required the state's Public Utility Commission (PUC) to develop standards for interconnection and operation of distributed generation facilities (renewables and natural gas-fueled), up to 10 megawatts of capacity. Each utility is required to file distributed generation tariffs consistent with the standards established by the PUC, as well as maintain records and file reports annually regarding applications for interconnection of distributed generation.

Xcel, the state's largest investor-owned utility, has established "Interconnection Guidelines for Parallel Operation of Distribution Connected Customer-Owned Generation" with a three-page preliminary application form and a five-page final application form.

Until other utilities tariffs are filed and approved, however, renewable energy system owners in those service areas are likely to be subject to a utility's existing interconnection requirements for "qualifying facilities" under the federal PURPA law. For more information, contact Minnesota's Public Utilities Commission.

Minnesota Contacts

Minnesota Department of Commerce State Energy Office

www.commerce.state.mn.us/pa ges/Energy/MainModTech.htm

Major efforts are to ensure reliable energy supplies, maximize the benefits of energy efficiency and develop Minnesota's renewable energy technologies.

For more information, contact:
Minnesota Department of Commerce
State Energy Office
85 7th Place E, Suite 500
St. Paul, MN 55101-2198
651-296-5175
energy.info@state.mn.us

Minnesota Public Utilities Commission

www.puc.state.mn.us

The Minnesota Public Utilities Commission (PUC) regulates electric, natural gas and telephone service. The Commission ensures that utilities provide safe, adequate, reliable service at fair, reasonable rates.

For more information, contact:
Minnesota Public Utilities Commission
121 7th Place E.Suite 350
St. Paul, MN 55101-2147
651-296-0406
consumer.puc@state.mn.us

Minnesotans for an Energy Efficient Economy

www.me3.org

Minnesotans for an Energy-Efficient Economy (ME3) is a non-profit organization leading the transition to a clean, efficient and fair energy system. ME3 uses a combination of strategies to ensure significant and sustained progress toward a clean energy future. First, ME3 is working for a phased-in adoption of clean energy technologies and the retirement of the inefficient, dirty technologies of the past. Second, ME3 encourages behavior changes that support clean technologies and the efficient use of energy resources. Third, ME3 pushes for policy reforms to change the economic factors that drive energy decisions and investments. Throughout their work, ME3 acts to empower citizens to influence decisions on energy and the environment.

For more information, contact:
Minnesotans for an Energy-Efficient Economy
Minnesota Building, Suite 600
46 East Fourth Street
St. Paul, MN 55101
651-225-0878
info@me3.org

Missouri

Financial Incentives and Programs

Energy Loan Program
This statute-based loan program is administered by the Energy Center of Missouri under the Department of Natural Resources. Loans are available for energy efficiency and renewable energy projects for public schools (K–12) and local governments. In the future, the next sectors to be targeted for assistance include private schools and hospitals. The loans are provided at a fixed interest rate below the market rate and repayment schedules are determined on an individual project basis. For more information, contact the Missouri Department of Natural Resources Energy Center.

Solar Easement
Allows property owners to create binding solar easements for the purpose of protecting and maintaining proper access to sunlight. For more information, contact the Missouri Department of Natural Resources Energy Center.

Net Metering
Missouri does not have net metering legislation at this time.

Interconnection
No interconnection guidelines are available at this time.

Missouri Contacts

Missouri Department of Natural Resources Energy Center
www.dnr.state.mo.us/de

The Missouri Department of Natural Resources Energy Center is a non-regulatory state agency that works to protect the environment and stimulate the economy through energy efficiency and renewable energy resources and technologies.

For more information, contact:
Missouri Department of Natural Resources Energy Center
P.O. Box 176
Jefferson City, MO 65102-0176
573-751-4000
energy@mail.dnr.state.mo.us

Missouri Public Service Commission
www.psc.state.mo.us

For information regarding electric rates, contact the Missouri Public Service Commission at:
Public Information Office
Governor Office Building
200 Madison Street
PO Box 360
Jefferson City, MO 65102-0360
573-751-3234
800-392-4211
pscinfo@mail.state.mo.us

Nebraska

Financial Incentives and Programs

Low Interest Loan Program for Energy Efficiency
This program makes available low-interest loans for residential and commercial energy efficiency improvements using photovoltaic technology. The Nebraska Energy Office administers this program, which was created in 1990 using oil overcharge funds.

Those seeking a loan under this program first approach their own financial institution, which approves the project on financial terms, before contacting the State Energy Office for its approval. The State Energy Office then buys half of the loan at zero percent interest so that the total interest on the loan "from the borrower's perspective"will be half the market rate obtained through their private lending institution. For more information, contact the Nebraska State Energy Office.

Solar and Wind Easements
Nebraska's solar easement provisions allow property owners to create binding solar easements for the purpose of protecting and maintaining proper access to sunlight. Nebraska's solar access laws were updated in March 1997 to include wind. Contact the Nebraska State Energy Office for more information.

Net Metering
Nebraska is in the process of developing net metering laws.

Interconnection
Interconnection guidelines are not available at this time.

Nebraska Contacts

Nebraska State Energy Office
www.nol.org/home/NEO

The mission of the Nebraska Energy Office is to promote the efficient, economic and environmentally responsible use of energy.

For more information, contact:
Nebraska Energy Office

P.O. Box 95085
1111 "O" Street, Suite 223
Lincoln, NE 68509-5085
402-471-2867
energy@mail.state.ne.us

Nebraska Public Service Commission
www.state.ne.us/home/NPSC

The Nebraska Public Service Commission (PSC) is responsible for regulating telecommunications companies, grain warehouses and dealers, private water companies, taxicab and limousine operators, intrastate trucking companies, the placement of certain electric transmission lines, railroads, manufactured homes, recreational vehicles and modular homes.

For more information, contact:
Nebraska Public Services Commission
P.O. Box 94927
Lincoln, NE 68509-4927
402-471-3101
800-526-0017

Wisconsin

Financial Incentives and Programs

Solar and Wind Energy Equipment Exemption
This statute exempts taxpayers from any value added by a qualified renewable energy system for property tax purposes. This exemption is available for all sectors and covers the total value of the systems, without a size limit. For more information, contact the Wisconsin Division of Energy. The relevant state statute is 70.111.

Wisconsin Municipal Utility Solar Energy Cash Allowance
Some of Wisconsin's municipal utilities support residential and commercial customers' use of solar energy by providing cash incentives for qualifying projects. The solar incentives vary from community to community but may include up to $1/watt installed for PV systems (maximum incentive of $1,000). Contact your local municipal utility to determine if the program is available in your area.

Public Benefits Fund
The Wisconsin public benefits fund provides funds for the state to award grants for low-income programs and energy efficiency and renewable energy services. Criteria that have been established for the grants include: targeting energy conservation services that are the least competitive in the market; promoting environmental protection, electric system reliability, rural economic development;encouraging customer-owned renewable systems; and promoting customer education about renewable energy.

Renewable energy sources are eligible and applicable sectors include commercial, industrial, residential, general public, and utilities. For more information, contact the Wisconsin Division of Energy.

Solar Easement and Solar Siting Protection
Wisconsin statute 66.0403 allows property owners with wind or solar energy systems to apply for permits that will guarantee unobstructed access to solar and wind resources. Permits may not be granted in the case where an obstruction already exists or if the construction of such an obstruction is well into the planning stages. Statute 66.0401 restricts local jurisdictions' siting considerations or conditions placed on siting for wind or solar systems to matters of public health and safety. Contact the Public Service Commission of Wisconsin for more information.

Net Metering
In 1993, the Public Service Commission of Wisconsin authorized net metering for customer-owned systems of 20 kW and below. Net metering is available only to customers of investor-owned utilities. All technologies—not just renewables and cogeneration units—are eligible. If a customer-generator operates a renewable energy facility, then the utility pays the retail rate for net excess generation; for non-renewable generation sources, the utility pays their avoided cost for net excess generation. Contact the Public Service Commission of Wisconsin for more information.

Interconnection
Wisconsin Administrative Code § 113.0207, "Requirements for utility rules for interconnection of small customer-owned generation facilities with the utility system," has been effective since October 1,1982. The Public Service Commission has opened a docket to rewrite the rules. Changes are being proposed regarding technical and legal issues and the amount of liability insurance that is required of a renewable energy system owner. The latest draft is available at *www.wisconsindr.org*. For more information, contact the Public Service Commission.

Wisconsin Contacts

Wisconsin Department of Administration Division of Energy
www.doa.state.wi.us/depb/boe

The Division of Energy advises the governor and legislature on policies and programs for state and regional energy management,

administers federal energy efficiency funds and develops and coordinates emergency energy policies and programs. Analysts maintain up-to-date information on availability, use, prices, and regulatory issues for oil, gas, coal, renewable energy resources, and energy efficiency techniques. The Division of Energy also houses the state Energy Information Clearinghouse which responds to public requests for information.

For more information, contact:
Wisconsin Division of Energy
101 East Wilson Street, 6th Floor
P.O. Box 7868
Madison, WI 53707-7868
608-266-8234
energy@doa.state.wi.us

Public Service Commission of Wisconsin

www.psc.wi.gov

The Public Service Commission of Wisconsin is an independent regulatory agency dedicated to serving the public interest. The agency is responsible for the regulation of Wisconsin public utilities, including those that are municipally owned.

For more information, contact:
Public Service Commission of Wisconsin
610 North Whitney Way
P.O. Box 7854
Madison, WI 53707-7854
608-267-2896

Energy Center of Wisconsin

www.ecw.org

The Energy Center of Wisconsin is a private, non-profit organization dedicated to improving energy efficiency in Wisconsin. The organization provides energy-efficiency programs, research and education to residents, businesses, industry and government.

For more information, contact:
ECW
595 Science Drive
Madison, WI 53711-1076
608-238-4601
ecw@ecw.org

RENEW Wisconsin

www.renewwisconsin.org

RENEW Wisconsin, a non-profit organization headquartered in Madison, promotes clean energy strategies for powering the state's economy in an environmentally responsible manner.

For more information, contact:
RENEW Wisconsin
222 South Hamilton Street
Madison, WI 53703
608-255-4044
mvickerman@renewwisconsin.org

Wisconsin Energy Conservation Corporation

www.weccusa.org/renewables

One of the current programs for the Wisconsin Energy Conservation Corporation (WEC), Wisconsin Focus on Energy, has created a Renewable Energy Program to be a one-stop resource for Wisconsin residents and businesses. People can learn about the different renewable energy sources and decide which is right for their home or business, register for education and training opportunities around the state, obtain technical and project assistance from renewable energy experts who can share decades of practical experience, and apply for funding opportunities such as installation cash-back rewards, demonstration grants, and technical assistance grants.

For more information, contact:
WECC
211 S. Paterson Street, 3rd Floor
Madison, WI 53703
608-249-9322