Renewable Energy Installers in New York State

A GUIDE FOR THE INSURANCE INDUSTRY

NYSERDA
New York State Energy Research and Development Authority

New York Energy Smart℠
Public Service Commission — NYSERDA

© Paul Buckowski, 2005

INTRODUCTION

With the higher cost of fossil fuels and concerns about environmental impacts, there has been considerable growth in the renewable energy industry. While much of the publicity goes to large wind turbine installations, the installation of solar photovoltaic systems and small wind turbines for residential and commercial customers has been steadily rising. For example, global shipments of photovoltaic products grew by 32% in 2003, generating $4.7 billion in revenue.

In New York State, the installation of these systems is generally done by small business owners that face many economic challenges, such as low capital availability and high fixed costs. One of the major fixed costs for the installers or practitioners is liability and workers compensation insurance. Because renewable energy installation is a relatively small, niche business, it may be difficult for the insurance industry to easily find actuarial information that can be used to assess risk and apply a premium that is reasonable to both the installer and the insurance carrier. The goal of this guide is to provide an overview of the business, what installers do on a daily basis, and what is known or not known about the risks.

This guide is the result of work supported by the New York State Energy Research and Development Authority (NYSERDA). NYSERDA is a public benefit corporation that administers the **New York Energy $mart**SM program, which provides energy efficiency services, including those directed at the low-income sector, research and development, and environmental protection activities. Through its Power Naturally SM Program (www.PowerNaturally.org), NYSERDA has helped educate thousands of potential customers and renewable energy system designers and installers about applications for solar electric and wind energy. This program also helps develop and implement a sustainable market for grid-connected solar electric or photovoltaic (PV) energy through financial incentives to consumers and a program to ensure that installations are performed by qualified professionals.

Photo Courtesy of Jennifer Harvey, 2005

WHAT IS RENEWABLE ENERGY?

The term renewable energy refers to any method of generating electricity or heat without the use of fossil or nuclear fuels. This can include solar, wind, hydro, and biomass (such as wood or agricultural wastes). In this guide, solar and wind power are discussed because they are currently the technologies most commonly handled by the businesses referenced here.

SOLAR/PHOTOVOLTAIC POWER

Solar or photovoltaic (PV) cells are made of semiconducting materials (similar to those used in computer chips) that can convert sunlight directly into electricity. When sunlight strikes the cells, they produce a direct electrical current (DC) without any moving parts . PV cells are combined to make modules that are encased in glass or clear plastic. Modules can be aggregated to make an array that is sized to each application (Figure 1).

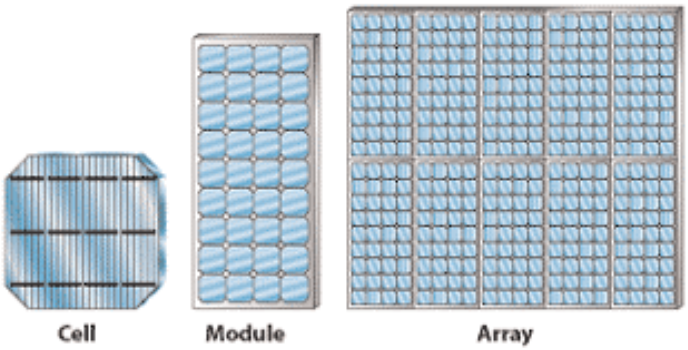


Figure 1. Example of how individual cells make up a module. An array consists of sets of modules (from the National Renewable Energy Laboratory, Golden, CO).

Solar panels are mounted either on a roof or on a post attached to the ground. The array is wired to an inverter, which converts the DC power to conventional alternating current (AC). In grid-connected systems, the power generated by the PV array is used to supplement the existing utility service with any excess power generated exported back into the power lines or grid (Figure 2). Batteries are not required because the grid supplies any extra demand, although some owners choose to install batteries for backup power during blackouts. As an aside, battery-backup systems have positive insurance benefits such as keeping a heating system in operation during winter conditions. For homes not connected to the power grid, batteries are used to store power.

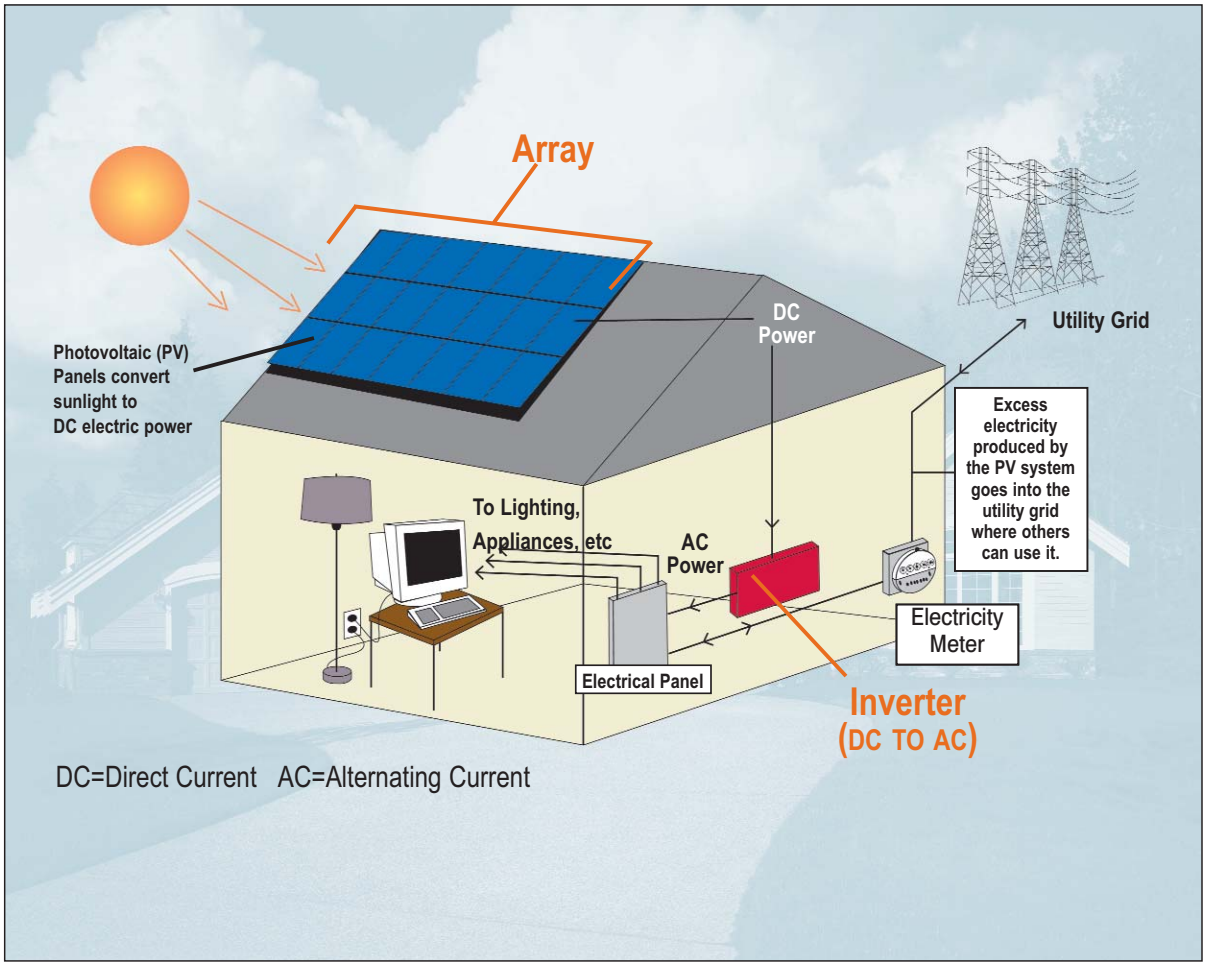


Figure 2. Diagram of a typical grid-connected PV system without a battery backup

SOLAR WATER HEATING

A solar water heating system is a different technology from PV. Solar water heaters consist of a loop of pipe containing water or non-toxic antifreeze that circulates from a rooftop collector to the hot water tank. Most installations in the colder regions of the United States, such as New York, use a closed loop heat exchanger that transfers the heat from the hot antifreeze to the cold water in a tank. This heats the water that is then fed into the existing electric water tank or into a pre-heating tank feeding to a fuel-fired hot water tank. On hot days, the solar system supplies the majority of the hot water needs, while on less sunny days, the system preheats the water before the conventional systems brings it up to the desired temperature.

WIND

Wind electric turbines use a propeller-style set of blades to drive a generator. Wind turbines can be subdivided into small and large (utility) sizes. Large wind turbines are used in centralized wind farms that generate power for the utility grid and are installed by large companies. Small wind turbines (Figure 3) are installed near the building to which they supply power. For the purposes of this guide, only the small wind turbines are of interest.

A turbine system consists of the blades and the generator placed on top of a tower. The power is sent several hundred feet through an underground cable to a nearby building. The size of a wind turbine is usually defined by its maximum ability to generate electricity as measured in kilowatts (kW). Small wind turbines for residential and commercial use are usually between 1 and 10 kW. Similar to PV systems, a wind generator can be grid-tied or off-grid with a battery backup. Many off-grid homes use a combination of PV, wind, and an engine-driven generator to provide power.

Figure 3. Photograph of a 10 kW turbine atop a guyed lattice tower (courtesy of Bergey Windpower)

THE RENEWABLE ENERGY PRACTITIONER

A professional installer or practitioner of PV and wind systems is an expert in renewable energy systems. This job requires a range of activities to initiate, set up, and maintain a system. In fact, the actual installation of the hardware can require only a small percentage of the total work that is done.

Photo Courtesy of Jennifer Harvey, 2005

For both solar and wind, the initial steps of a typical installation are similar as the practitioner:

- responds to a request by the building owner to provide an initial site survey;
- determines the needs and desires of the owner. This entails analyzing utility bills to determine energy requirements, observing the orientation of the building relative to the sun or wind resource, and working closely with the owner to communicate how the technology works and how it can be integrated into the site. It may also entail a multi-month wind audit to more accurately gauge the wind speed and percentage of time the wind is available;
- explains the existing regulations (zoning, interconnection, etc.) and government incentives that can reduce the price of the installation;
- provides a system design, which is one of the more time consuming activities since it must be done carefully; and
- prepares a quote for the prospective client.

The systems are designed by properly selecting UL-listed subcomponents to maximize performance and reliability within the customer's budget. It is similar to an electrician in which all installed parts are off the shelf and produced by established companies.

INSTALLATION OF SOLAR/PHOTOVOLTAIC

Solar PV arrays are generally installed in an area that is south facing and free of obstructions that may obscure the sunlight. The array can either be mounted on a post or on a suitable roof section (Figure 4). Pole-mounted systems are used where shading or roof space is an issue. New plug-and-play mounting hardware allows the installer to spend minimal time on the roof with fewer penetrations needed to secure the PV array. An average roof installation of a 2 kW array may take four to six hours on the roof and an additional eight to ten hours of installing wires, inverter, and meters.

(a)

Figure 4. a) A typical roof-mounted PV system (courtesy of C. Sinton); b) An example of a pole-mounted PV array (courtesy of Four Winds Renewable Energy).

(b)

Photo Courtesy of D. Buckner

INSTALLATION OF SMALL WIND TURBINES

Most small wind turbines are placed on top of 80 to 120 feet high metal towers. Turbines that are of 5 to 10 kW capacity are placed on stand alone lattice towers or wire-guyed lattice towers. In most cases, the tower is assembled on the ground. Using a crane, the completed tower is lifted high enough to attach the turbine, then the tower and turbine are lifted and placed into position. The crane is on the site for an average of three hours. A person is needed to climb the tower to remove the sling from the crane. Once a year, the installer is required to climb the tower for a two hour maintenance visit. When climbing is required, it is done with OSHA-approved safety equipment. Turbines over 10kW are usually set up with an authorized factory installer team on site. In fact, under NYSERDA's eligible wind installer guidelines, factory supervision is required for larger turbines(see following section).

The smallest turbines (0.5 to 3 kW) are installed on tilt-up towers. Tilt-up towers are guyed lattice or pipe towers that have the wind generator assembled and attached on the ground. The tower is raised upright using a winch, truck, or tractor. Guy wires are then secured to keep the tower supported. There is no climbing involved with a tilt-up tower and the tower is lowered to the ground to conduct maintenance.

INTERCONNECTION OF PV AND WIND SYSTEMS

For PV and wind systems that are used in buildings and supplied power by the utility grid, the installer must ensure proper interconnection. All interconnections must meet standardized interconnection requirements promulgated by the State. Most utilities require a formal interconnection agreement. The wiring and interconnection of a typical PV system can take one to two work days.

BATTERY SYSTEMS

A back up battery system can be used in both grid connected and stand alone systems. The batteries store power for use during low wind/sun conditions and in the event of a power outage. A battery charge controller is installed to regulate the charging of the batteries and prevent overcharging. Lead-acid batteries are used in a vented enclosure.

© Paul Buckowski, 2005

Sealed batteries are frequently used where venting is not feasible or desired.

MAINTENANCE AND REPAIR

The practitioner is responsible for maintaining and repairing the systems that he or she installs. PV systems require little maintenance because there are no moving parts and PV panels can last 25 to 30 years. Wind turbines should have annual maintenance and bearing replacement every five years. NYSERDA PV and wind incentives require the installer to provide full parts and labor warranties for 5 years.

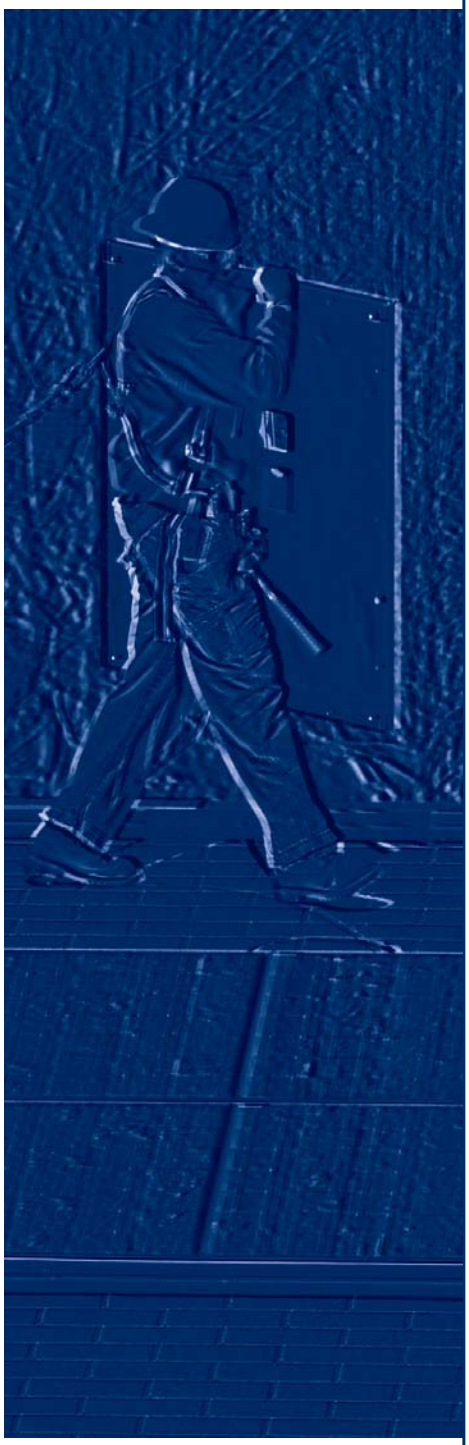
INSTALLER CERTIFICATION AND SAFETY TRAINING PROGRAMS

Most installers are trained to ensure that all work is completed safely. Most equipment manufacturers insist that installers are trained before using their components. Some companies will not give extended warranties to systems not installed by certified installers. In addition to training by component manufacturers, there are several other opportunities for installers to be trained and certified. NYSERDA also sponsors training related to PV system design, installation, code compliance, as well as OSHA safety requirements.

NORTH AMERICAN BOARD OF CERTIFIED ENERGY PRACTITIONERS (NABCEP)

The North American Board of Certified Energy Practitioners (NABCEP) is a volunteer board of renewable energy representatives. Its mission is to support and work with the renewable energy and energy efficiency industries, professionals, and stakeholders to develop and implement a quality credential and certification programs for practitioners. NABCEP has a voluntary certification process for PV installers and is developing a program for wind installers. The NABCEP certification provides a set of national standards by which PV installers with skills and experience can distinguish themselves. Certification provides assurance to consumers that their installer has met the needed performance standards to install safe and reliable systems. The NABCEP PV installer certification has been developed in accordance with industry best practices. NYSERDA works closely with PV installers to help them prepare for NABCEP certification.

TO BE ELIGIBLE FOR NABCEP CERTIFICATION, A PV INSTALLER MUST:



1. be at least 18 years of age;
2. meet prerequisites of related experience and/or education for one of the seven following different entry tracks:
   - four years of experience installing PV; OR
   - two years of experience installing PV systems in addition to completing a board-recognized training program; OR
   - be an existing licensed contractor in good standing in solar or electrical-construction related areas with one year of experience installing PV systems; OR
   - four years of electrical-construction related experience working for a licensed contractor, including one year of experience installing PV systems; OR
   - three years experience in a U.S. Dept. of Labor approved electrical-construction trade apprentice program, including one year of experience installing PV systems; OR
   - two-year electrical-construction related, or electrical engineering technology, or renewable energy technology/technician degree from an educational institution plus one year of experience installing PV systems; OR
   - four-year construction related or engineering degree from an educational institution, including one year experience installing PV systems.
3. complete an application form documenting requirements;
4. sign a code of ethics;
5. pay applicable fees; and
6. pass a four hour, written exam that tests knowledge of the relevant National Electrical Code sections, knowledge of safety practices, PV-system assessments, installation requirements, and customer interaction issues.

Recertification is required every three years. The requirements for recertification are three documented system installations for the previous three year period and 18 hours of continued education consisting of a minimum of three hours of safety training and 12 hours of technical education.

NATIONAL CODES

All solar and wind systems must conform to local plumbing, electrical, and building codes. In addition to local codes, there are national codes with the most relevant being the National Electrical Code (NEC) of the National Fire Protection Association (NFPA). The NEC is the most widely adopted code in the world and is used in every state in the nation. The NEC describes the safe installation of electric conductors and equipment in public and private buildings or other structures. Article 690 of the NEC, which was first drafted in 1984, specifically addresses the design and installation of photovoltaic systems and equipment, and includes requirements for sizing and protection of circuits, disconnect means, wiring methods, grounding, marking and connections to other sources. The NFPA regularly offers courses around the nation for installers. NYSERDA has also sponsored NEC training courses across the State for installers, inspectors, and code officials

The Institute of Electrical and Electronics Engineers (IEEE) publishes the National Electrical Safety Code (NESC), which sets rules for "the practical safeguarding of persons during the installation, operation or maintenance of electric supply and communications lines and associated equipment". The NESC details what is needed for the safety of workers and the public. The NESC differs from the NEC in that the NEC addresses proper electrical systems and equipment installation while the NESC describes proper installation procedures.

All renewable energy systems installed under NYSERDA programs must meet all applicable Federal, and State codes and standards.

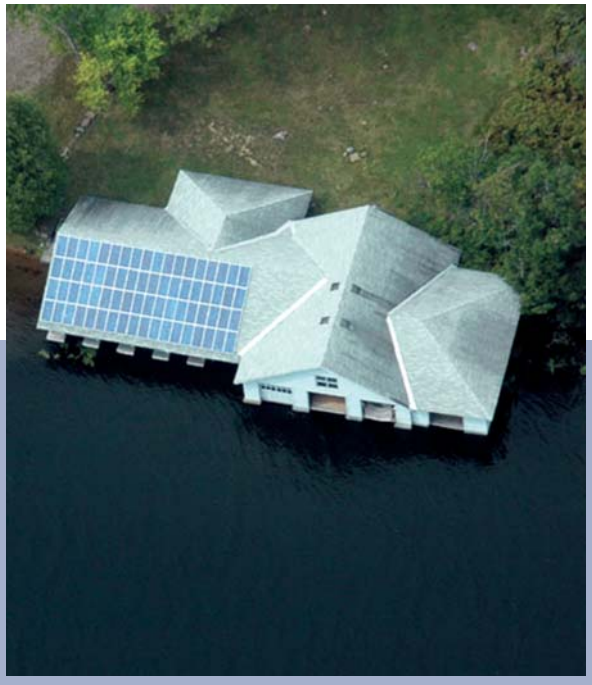
ACCREDITED PV TRAINING PROGRAMS

NYSERDA has partnered with the New York State Solar Energy Industry Association (NYSEIA), universities, and other educational programs across New York State to develop accredited technical training and education programs to help prepare PV installers for certification by NABCEP. Accreditation of the training programs is awarded by the Institute for Sustainable Power (ISP). The ISP is a non-profit organization working to build a global training accreditation and certification program for PV systems design, installation, and maintenance practitioners. Accreditation measures a program against certain defined standards. Visit www.ispg.org for more information about the ISP.

© Paul Buckowski, 2005

NYSERDA ELIGIBLE INSTALLERS

NYSERDA has implemented a program that provides cash incentives to consumers through eligible installers for the installation of approved PV and small wind systems in New York State. In order for consumers to take advantage of the incentives, an eligible installer must be chosen for the installation. Eligible installers are evaluated using several criteria, including installation experience, credentials, employment history, and past performance. Preference is given to training that is obtained from nationally accredited training programs and courses taught by nationally certified instructors. If an installer does not meet all program requirements, an installer may be approved as an eligible installer on a provisional basis.



Photos Courtesy of Jennifer Harvey, 2005

EXPOSURE TO RISK AND HISTORY OF CLAIMS

According to most sources, there has never been a recorded injury or death associated with the installation of PV or wind system. However, it can be difficult to find specific, published information on the exposure to risk and history of insurance claims due to the few installers that are classified as such. Most installers are classified as electricians or general contractors by their liability and workers' compensation carriers.

Because of the variability of tasks that the renewable practitioner undertakes, it is not easy to make a direct comparison to a more widely recognized profession. The closest comparison would be an electrician, since a large part of the installation procedure requires electrical work. However, as described previously, there are some distinct differences which can make renewable installations higher and lower risk. The general consensus is that PV presents no greater liability than any other energy-producing technology and probably less than most because it involves, in part, low voltage systems, no moving parts, and requires no flammable fuel or flame. Wind systems may pose a larger risk due to the movement of the turbine and the height of the tower. Still, according to the American Wind Energy Association, thousands of wind turbines have been installed in the U.S. with an excellent safety track record.

In order to assess the risk exposure, the liabilities associated with the installation of a renewable energy system can be divided into four general areas:
1) The liabilities for which the manufacturer would be responsible;
2) The liabilities for the design firm;
3) The liabilities associated with the on-site installation; and
4) The liabilities associated with maintenance of the system.

The manufacturer is liable for defects in the equipment, although modern solar and wind equipment meet all safety requirements. According to one study, "the position of the PV equipment manufacturers is that compliance with national standards, including those developed by the Institute of Electrical and Electronics Engineers (IEEE) and Underwriters Laboratories (UL), ensure that PV systems are incapable of causing the safety or power quality problems of concern to the utilities."

The installer is responsible for the other three areas. Increased risk in these areas can be directly attributed to lack of experience, lack of training and certification, lack of knowledge of codes and utility interconnection requirements, and possibly the division of labor (such as subcontracting). If an installer is certified by an accepted organization and can demonstrate experience and knowledge of the profession, exposure to risk will be significantly decreased.

OPPORTUNITIES FOR THE INSURANCE INDUSTRY

Renewable energy technology and the professionals that install them have come a long way over the past several decades. The system components are massed produced by established companies and adhere to strict safety codes. The professional installers have access to several training and certification programs that can increase the likelihood of safe installation. And the profession is set to grow. For example, in New York alone, at least 1,000 PV installations at a cost of approximately $30 million have been installed in recent years. The U.S. Department of Energy Million Solar Roofs Initiative is aimed at facilitating the sale and installation of one million solar systems by 2010. The United States PV industry wants to move from a billion dollar industry employing 20,000 people to a multi-billion dollar business employing 150,000 people by 2020. Many of these people will be professional installers that require insurance coverage. What is needed are insurance carriers that are eager to add new lines of business by learning more about the profession and offering services that are priced so that all parties benefit.

Photo Courtesy ISI Solar, 2005

What is Energy?

Energy is the ability to do work. The basic unit of electrical energy is the kilowatt-hour or kWh. It is the amount of energy derived from running a 1 kilowatt (kW) generator for one hour.

Watt–the most basic unit of capacity that indicates the size of an electric energy generator.

A kilowatt equals 1000 Watts

A megawatt is 1 million Watts or a MW. A MW equals 1000 kW.

The "W "is always capitalized when abbreviated since it is named after James Watt who was instrumental in development of the steam engine. So it is kW, kWh, MW and MWh.

How Much Energy is a kilowatt, a megawatt?

A typical home may use 2 to 3 kilowatts (kW) of capacity at any given time.

A small electric burner may be 1.5 kW while a large one may be 3 kW.

If you run a 1 kW appliance for an hour, it will be 1 kilowatt- hour (kWh) of energy and cost from $0.07 to $0.13 depending on where you live.

A one megawatt (MW) sized power plant can power from 300 to 500 homes

A large electric plant can be from 700 MW to 1200 MW in capacity

Prepared by:
Christopher W. Sinton
C.W. Sinton Consulting

Joel Gordes, Executive Vice President,
NY Solar Energy Industries Association

Roy Butler, Owner
Four Winds Renewable Energy

© Paul Buckowski, 2005

State of New York
David A. Paterson, Governor

New York State
Energy Research and Development Authority

Vincent A. DeIorio, Esq., Chairman
Paul D. Tonko, President and CEO

New York Energy Smart℠
Public Service Commission — NYSERDA

www.PowerNaturally.org
www.nyserda.org

NYSERDA
New York State
Energy Research and
Development Authority