Solar Electricity Photovoltaics (PV)

Illinois Solar Energy Association *www.IllinoisSolar.org*
A chapter of the American Solar Energy Society and a 501(c)3 organization

Solar Photovoltaics (PV)

Photovoltaic solar cells convert sunlight directly into electricity. The simplest PV cells power watches and calculators. Larger arrays of PV cells generate electricity for homes, businesses and even cities. PV systems can be integrated directly into building shells, operate independently or linked to the electric utility grid. Systems are modular (units can be added as needed), are silent, produce no emissions, and operate during the hours of highest daytime electrical demand. PV cells and panels are solid state with no moving parts.

Types of Photovoltaic Systems - Utility Grid Interconnected

Also known as on-grid or grid-tie, grid connected systems generate solar electricity and route it through the electric utility grid, offsetting a home's or business's electrical consumption and, in some instances, even turning the electric meter backwards. On sunny afternoons if the PV system is generating more electricity than required, excess electricity may be sold back to the power company. The building continues to buy electricity from the grid during nighttime or cloudy periods. There is no need to store the energy with batteries. Grid connected systems are the simplest and most efficient PV set up, consisting primarily of PV panels and a grid-tie inverter. Living with a grid-connected solar-electric system is no different than living with grid power, except that some or all of the electricity you use comes from the sun.

Off-Grid or Independent

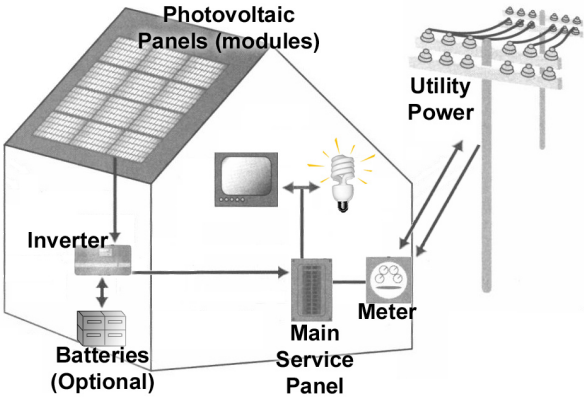
These systems operate independently of the utility grid by utilizing batteries as a storage medium. Off-grid systems make the most sense with buildings already located away from the utility grid. If a building is located a certain distance from the grid, it may be cheaper to install a PV system than to connect. Plus, you won't be receiving a monthly electric bill.

Grid-connected with Battery Backup, also called Bi-Modal

These are the same as grid-connected systems except they also include a set of batteries to serve as a backup energy source just in case the grid fails. A special kind of inverter is used that can automatically work off or on the grid. So if the utility power goes out (blackout), the building will continue to have electricity from the batteries for a designed period of time. The battery capacity is usually smaller than for an off-grid system.

Components of a Grid-Tied PV System

Photovoltaic systems (PV) use **panels** made from semiconductor materials that convert sunlight into electricity. The sun's photons strike the semiconductor material, dislodging electrons and creating a direct current, which is converted by the **inverter** to the standard alternating current. PV panels are also called *modules*.



Yes, Illinois,
A PV system in Springfield, Illinois can produce almost as much electricity as an identical one in Miami, Florida.

The Value of a Photovoltaic System

For a premium investment, individuals and businesses can obtain a lifetime of electricity from a renewable source that is clean, non-polluting and "made" locally. Solar electric systems are some of the most reliable products available today. PV panels have manufacturer warranties of up to 25 years. Unlike conventional power sources, PV's expense is all up front. Thereafter the energy is "free", with little operational costs, and insulated from utility price increases. PV means reduced pollution and climate change and conserving resources for future generations. When it comes to home value, a solar power system is a good "remodel" option as well. A study by the Appraisal Institute reports a home's value increases $20 for every $1 reduction in annual energy bills. Studies from the American Solar Energy Society and the National Renewable Energy Laboratory indicate that PV home sales recover most or all of the post-incentive installation costs and sell faster than non-PV homes of comparable value.

Types of Photovoltaic Panels

Most photovoltaic panels are made from crystalline cells. The majority of these cells are polycrystalline, which are typically blue or gray with a sparkly appearance. Other cells are mono-crystalline, which are often a flat gray, black or other dark color in appearance. Thin films, which are deposits of photovoltaic material on glass, metal or other surfaces, come from a variety of different silicon and non-silicon formulas and are increasingly popular. Other types of PV panels contain ribbon, string or other kinds of silicon and non-silicon materials. PV panels are made by companies with familiar brand names as well as new companies.

Building Integrated PV (BIPV)

Newer PV products can now also double as roofing or building materials such as curtain walls. These products can be more aesthetically pleasing and serve the dual purpose of protecting the building from weather while generating electricity. Because BIPV can actually begin to replace building material, savings can be realized during construction, especially when incentives are factored in. BIPV buildings may also gain additional market value.

Photovoltaics Incentives

There are a variety of federal tax credits, state rebates and grants available for photovoltaic systems in Illinois. In order to qualify for these incentives and ensure quality components, PV panels and other components should be Underwriters Laboratories® listed and installed under National Electric Code standards. As these incentives are changing, the best way to find the latest is the Database of State Incentives for Renewable Energy (DSIRE) at *www.dsireusa.org*, and click on the Illinois or Federal maps. Other Illinois and Federal sites that have the latest incentive information are:

Federal tax credits for residential and business – Solar Energy Industries Assn *www.seia.org* go to Guide to Federal Tax Incentives button

Illinois state rebate residential and business - Illinois Dept of Commerce and Economic Opportunity *www.commerce.state.il.us/dceo/Bureaus/Energy_Recycling/Energy/Clean+Energy/Illinois*

Nonprofit and government – Illinois Clean Energy Community Foundation *www.illinoiscleanenergy.org*

For more information:

- Solar Today Magazine. *www.solartoday.com* The magazine of the American Solar Energy Society (ASES) with stories about installations as well as the "big picture" on solar energy
- (NABCEP) *www.nabcep.org/list.cfm* North American Board of Certified Energy Practitioners - List of certified PV installers.
- Find solar *www.findsolar.com* – an ASES-supported site that will help you locate solar contractors.
- The Illinios Renewable Energy Assn. *www.Illinoisrenew.org* annual August energy and sustainable lifestyle fair in Oregon, IL.

JOIN the ISEA in the common goal of promoting solar/renewable technologies, providing energy education and establishing a sustainable energy network. Your support today can help provide a cleaner environment tomorrow. Become a member today.

Illinois Solar Energy Association
P.O. Box 634, Wheaton, IL 60189
(630) 260-0424
info@illinoissolar.org
www.IllinoisSolar.org

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