

Photovoltaic Systems

Converting Sun Rays into Electricity

Photovoltaic (PV) systems, more commonly known as solar electric systems, turn sunlight into electricity. Solar panels are wired together to form an array that connects directly with the home's electrical system. When the sun shines, the panels produce power.

If grid-tied, when the solar system is making more power than the home needs, the excess power gets fed into the grid. The homeowner may be able to be paid for this excess power by the power company or other incentive program. Likewise, during times when the array is not producing enough power for the home, the homeowner can buy the difference needed from the grid. The process is seamless and automatic.

If the home is not connected to the grid, the excess power produced by the solar array may be stored in batteries and used later when needed. Other options are available to manage excess power use but are less common. Oftentimes homeowners choose to mix what they do with the excess power by storing some of it in batteries and feeding some of it to the grid. A benefit of storing power in batteries is the ability to have electricity during power shortages and power outages. This factsheet will focus on PV systems that feed the excess power produced into the local utility grid.

Why PV?

More than 20,000 homes in the United States get some or all of their electricity from PV systems. The universal appeal of solar panels lies in the fact that they generate free electricity from sunlight. Working PV systems are relatively simple in design, have no moving parts, and need little maintenance. They simply and silently produce electricity whenever exposed to sunlight.

Georgia is a great site for the development and use of solar technologies. In fact, you may have already used PV systems without even knowing it. Many calculators, satellites, phone booths, and road signs run off solar power.

Benefits of using PV systems include:

- ❑ Using a pollution-free and infinitely renewable fuel source.
- ❑ Usable anywhere there is direct sunlight.
- ❑ Often less expensive than grid electricity hook-ups in remote places.
- ❑ Helping create a more sustainable and independent energy future for Georgia and the United States.
- ❑ The knowledge that you are doing the right thing for the environment and public health.

PV Myths and Facts

Myth: Solar power is too expensive to be practical.

Fact:

- ❑ Manufacturing costs for solar panels are declining each year through new research and economies of scale.
- ❑ Once the parts are purchased and installed, solar power costs nothing.

Myth: PV systems are ugly and unreliable.

Fact:

- ❑ Solar panels on homes are typically installed using low-profile mounting brackets. The sleek panels are placed almost flush against the roof. Roof-integrated solar shingles are available as well.
- ❑ PV systems are known for their dependability; warranties are typically 20 years.

Myth: It takes more energy to produce a solar panel than that panel will generate in its lifetime.

Fact:

- ❑ A solar panel will generate a minimum of four times the amount of energy used in its production. Soon, panels will be generating 20 times the energy required for their production.
- ❑ No pollution is created during the use of solar panels.

Myth: PV power is a nice idea, but it will never compete with conventional fuels

Fact:

- ❑ The solar energy industry is currently growing at a rate of 25 percent each year.
- ❑ Fossil fuels may be depleted within 40 years.
- ❑ Because the fossil fuel industry receives an estimated \$15 billion each year in federal government subsidies, the solar industry currently has a tough time competing.



Above left: The Captain Planet EarthCraft House in Brookhaven.

Above right: The Westbrook Solar EarthCraft House in north Atlanta

Below left: Suwannee River Visitor Center located in Fargo, Ga. This is the first EarthCraft House to be certified in south Georgia. The Solar Energy Cottage is adjacent to the Visitor's Center and will be used as an administration building.

Costs

The first step in considering solar is to adopt energy efficiency measures. A thorough energy audit will show homeowners ways to substantially reduce their home's energy use, and thereby reduce the size and cost of their PV system.

Key energy efficient measures that make any solar-powered home reasonable in cost are:

- ❑ Good airsealing and tight duct work.
- ❑ Energy efficient lighting.
- ❑ High efficiency appliances that meet or exceed ENERGY STAR® standards.
- ❑ Properly sized, high efficiency heating and cooling systems.
- ❑ Water heating provided by a solar water heating system.

How much will a system cost upfront?

When solar manufacturers and installers talk about costs, they usually speak in terms of dollars per installed watt. Residential PV systems are typically \$8-11 per watt.

Using this rough measure of installed costs, one can come up with a total installed cost range from \$5,500 to \$22,500 for 0.5kW-3kW residential PV systems. (kW = kilowatt or 1000 watts)

What size system is needed?

The size of a PV system depends on the appliances, home size, and site. Proper solar panel installation requires a southern orientation that receives direct sunlight from 9am to 3pm daily.

PV systems may be designed to provide any amount of power depending on the specific needs of the homeowner. For example, the four-bedroom, three-story home shown in Photo 1 has a 2kW PV system that produces 30 percent of the energy needed to run the home. The three-bedroom single story home shown in Photo 2 has a 4 kW system that produces 100 percent of the energy needed to run the home.

A major benefit of solar power is the ability to easily expand a system's size and increase the amount of energy being produced.

State and Federal Incentives

PV costs can be cut remarkably by government tax credits, incentives and financing deals. The North Carolina Solar Center has put together an online Database for State Incentives for Renewable Energy (DSIRE), a comprehensive list of incentives in each state. One should also check with the local utility company or EMC for their incentives.

A few highlights from DSIRE:

- ❑ Georgia mandates net metering, an arrangement which guarantees a homeowner's excess PV power may be sold back to the power company. The buyback rate depends on the utility company. Because some buyback rates are low, it may be more profitable for the homeowner to have their meter run backwards during times of excess energy production.
- ❑ TVA has launched Green Power Switch, a program that pays TVA-connected homeowners 15 cents for every kilowatt hour of PV power they generate.

- ❑ Mainstay Energy's Rewards Program will pay any homeowner with a PV installation a few cents per kilowatt-hour generated, but they will not pay on top of any other buyback incentive programs.

- ❑ Currently there are no federal incentives for homeowners to install PV systems, but legislation has been suggested.

- ❑ To learn more visit www.dsireusa.org

Payback

Payback time is a measure of how long it takes for the home energy savings to repay the cost of the PV system. Using incentives such as the TVA Green Power Switch can dramatically decrease the payback time helping the system pay for itself faster. New home buyers have the option of adding the cost of the PV system into their mortgage.

Those unable to purchase a PV system at this time can still support the solar industry by joining the Green Power Electric Membership Corporation (EMC). The Green Power EMC is a partnership among sixteen Georgia EMCs made to offer their customers the option of supporting renewable energy from Georgia resources including solar, wind, biomass, and water to supply their electric needs.

Considering current market conditions, it is probably best to think about PV power as an investment in energy security and environmental responsibility, as opposed to being purely financial. By owning a PV array and generating clean electricity, one becomes part of the energy movement and gains some independence from the price fluctuations and negative impacts of fossil fuels. Now that's more than can be said about remodeling the bathroom!

Additional Resources

For more information on photovoltaics or to find an installer near you, contact:

American Solar Energy Society

Solar Today Magazine
2400 Central Ave., B-1
Boulder, CO 80301
(303) 443-3130
ases@ases.org
www.ases.org/solar

Florida Solar Energy Center,

Public Information Office
1679 Clearlake Rd.
Cocoa, FL 32922
(321) 638-1000
www.fsec.ucs.edu

Georgia Solar Energy Association (GSEA)

PO Box 728
Athens, GA 30603
(912) 596-1780

Green Power EMC

2100 East Exchange Place
Tucker, Georgia 30084
www.greenpoweremc.com

Home Power Magazine

PO Box 520
Ashland, OR 97520
(541) 512-0201
www.homepower.com

Interstate Renewable Energy Council (IREC)

P.O. Box 1156
Latham, New York 12110-1156
(518) 458-6059 (phone & fax)
www.irecusa.org

National Renewable Energy Laboratory (NREL)

Technical Publications
1617 Cole Boulevard
Golden, CO 80401
(303) 275-4363
www.nrel.gov

North American Board of Certified Energy Practitioners (NABCEP)

10 Hermes Rd. Suite 400
Malta, NY 12020
(518) 889-8126
info@nabcep.org
www.nabcep.org

North Carolina Solar Center

Box 7401
North Carolina State University
Raleigh, NC 27695-7401
(919) 515-5666
ncsun@ncsu.edu

Solar Energy Industries Association (SEIA)

805 15th St. NW, Suite 510
Washington, DC 20005
(202)682-0556
http://www.seia.org

Southface Energy Institute

241 Pine St. NE
Atlanta, GA 30308
(404) 872-3549
info@southface.org
www.southface.org

Tennessee Valley Authority

Corporate Headquarters
400 W. Summit Hill Dr.
Knoxville, TN 37902-1499
Phone: (865) 632-2101
www.tva.com

U.S. Department of Energy

Energy Efficiency and Renewable
Energy (EERE)
www.eere.energy.gov