

A HOMEOWNER'S GUIDE TO Solar Electric Systems

Producing your own electricity with a rooftop solar photovoltaic (PV) system can have several benefits, including reducing your electric needs from the local utility grid and buffering you from volatile energy costs. A typical residential system can cost between \$10,000–\$30,000, but there are a number of rebates, tax breaks and other incentives that can significantly reduce the cost of installing a PV system. For those who have the tax liability to take advantage of the state and federal tax credits available through 2016, solar PV systems can make good bottom-line sense.

Today, a residential PV system will cost \$7 to \$10 per watt of output power (or about 20 to 35 cents per kilowatt-hour, without factoring in available tax credits), including all parts and installation. Although some power electronic components may require periodic replacement, the system can run virtually maintenance-free in any climate for 25 years or more.

Remember that efficiency is cheaper than PV and serves as an important building block toward smarter energy consumption and lower monthly costs. Spending tens of thousands of dollars to generate electricity to power inefficient lights, appliances and electronics simply doesn't make sense. So before installing a PV system, a home energy audit is a smart idea. Purchasing Energy Star appliances, lighting and other electronics is also a good way to save energy. Even turning off the lights and minimizing air-conditioning usage will go a long way to reducing your overall energy needs and could help you make a smaller, less-expensive PV system the best choice.

A PV System in Detail

A typical PV system is made up of the array, the inverter and a number of other components collectively referred to as balance of system (BOS).

Array. The array is a series of PV modules, which themselves are composed of numerous PV cells. The cells are made mostly of silicon or another semiconducting material that converts incoming light energy into electricity. Although there are many emerging PV cell materials and designs, those that are widely commercialized include single-crystal silicon, polycrystalline silicon, and thin-film modules made from amorphous silicon, cadmium-telluride or other materials.

Inverter. An inverter is a power-conditioning device that converts the incoming direct-current (DC) power from the PV array into grid-compatible alternating-current (AC) power.

Though the PV array and mounting structure will typically last for 25 years or more, most inverters are guaranteed for only 5 to 10 years. As a result, periodic replacement of the inverter is an important consideration.

Balance of system. The BOS components include the mounting structure, wiring, switches and a metering apparatus that facilitates grid integration (Figure 1). Most of the PV installations today are in homes that are tied to the electric grid because adding batteries can significantly increase the cost and maintenance of a PV system.

Incentives

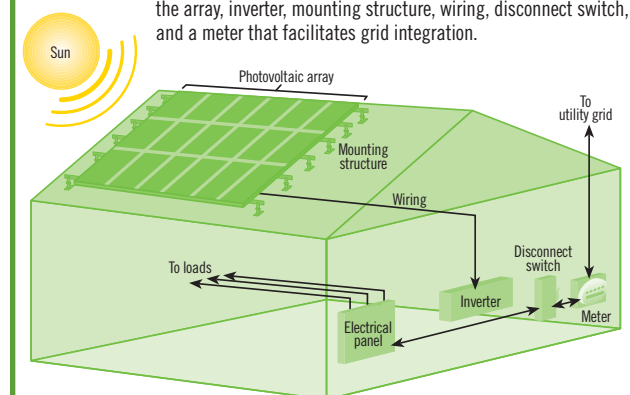
The U.S. government offers a 30 percent federal tax credit for any residential solar PV system installed between now and December 31, 2016.

North Carolina currently offers a 35 percent personal tax credit on solar electric systems. The credit may not exceed \$10,500. North Carolina now also allows a local property tax exemption of 80 percent of the appraised value of a PV system. Residents also may receive premium payments for the power generated by their solar premium from the statewide NC GreenPower program.

In addition to these incentives, a solar PV system—unlike many other home improvement expenditures—will pay for itself over time. A typical payback timeframe for an individual who is able to take advantage of available state and federal tax credits will range between 7 and 18 years, depending on a variety of factors. After that point, the system will continue to produce power from the sun, resulting in a positive cash flow on your solar investment.

FIGURE 1: Schematic of a residential grid tied photovoltaic system

The key components of a residential photovoltaic system include the array, inverter, mounting structure, wiring, disconnect switch, and a meter that facilitates grid integration.



Note: The placement and type of disconnect switch will be determined by policies implemented by your electric cooperative.

Courtesy: Esaurce

The best place for homeowners to find local and national rebates and incentives, as well as information on grid interconnection, is the Database of State Incentives for Renewables & Efficiency (www.dsireusa.org).

Evaluating Your Home for PV

When considering a solar electric system for your home, take into account the available solar resource, the condition of your roof, the size of the PV system, and any shade that could hinder system performance. These are factors a qualified solar contractor should measure and take into account when visiting your home for a consultation.

Available solar resource. Solar resource refers to the average annual amount of sunlight that reaches a given site. The greater the solar resource, the more energy a particular PV array will generate. A qualified contractor can provide this information for you, or you can do it yourself with a free online calculation tool from the National Renewable Energy Laboratory called PVWATTS (http://rredc.nrel.gov/solar/codes_algs/PVWATTS).

Condition of the existing roof. It's important that you evaluate the condition of your roof prior to installing a PV array because the cost of repairs or a complete re-roofing will be substantially greater once the array is in place. If the existing roof is in poor condition, the time to address that problem is before the array is installed.

Size of the system. Residential PV systems can span a large range in terms of capacity and price. The size of a

PV system depends on many factors, including your budget, annual energy consumption, amount of usable roof space, orientation of home, nearby trees and so forth. Working with a qualified contractor will help you select a system that best matches your needs.

Shading. A PV array that is even partially shaded will generate less electricity than one that is in direct sunlight. But what many people don't realize is the drop in electric output can be disproportionately larger than the amount of shade provided by a nearby tree or building due to engineering constraints in the construction of PV panels. However, it is important to realize that going outdoors and chopping down all the trees near your house to make way for a PV system would probably be a poor choice—without that shade, your home will get hotter in the summer and may require more electricity to cool.

Using software tools, a qualified contractor can easily assess the degree of shading a proposed array will experience throughout the year and determine the best PV design and placement for optimum electricity output.

Selecting Qualified Installers

Once you've addressed energy efficiency in your home and are ready to consider investing in a solar PV system, the next important step is selecting the right contractor. But as the demand for PV systems has boomed in recent years, so too has the number of contractors in the field who lack qualification or formal training in PV system design, installation or relevant electric codes.

Since 2003, the best indicator of contractor competence has been certification by the North American Board of Certified Energy Practitioners (NABCEP). This certification is given to PV installers who pass a rigorous exam and demonstrate that they possess a high degree of experience or education related to PV system design and installation. Contractors are listed in the NABCEP database (www.nabcep.org).

Another resource for finding local contractors and reviewing their certifications is www.Findsolar.com.

Maintenance Considerations

Once your PV array is installed, little system maintenance is required. The modules have no moving parts and usually carry a warranty of at least 20 years. Regular rainfall is often sufficient to eliminate dirt accumulation, but where rain is infrequent, occasionally rinsing the modules off with water will restore full-power operation. In some locations it's helpful (if it's possible) to remove snow from panels that have a particularly shallow slope.

Inverters require maintenance far more frequently than the modules do, but in most cases, the system owner's role is limited to monitoring the status indicators and notifying the installer that the inverter needs service. ⚡

Sources

Thanks to Southern Energy Management for resource help and graphics. Southern Energy management is a leading provider of sustainable energy services in North Carolina. (866) 575-9191. www.southern-energy.com

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