

Science You Can Use

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Dear Science: I'm thinking about installing a residential "net-metering" solar-photovoltaic (solar-PV) system for my house. What should I consider when making this decision? -- Buck R.

Dear Buck: A *solar-PV system* is an array of photovoltaic cells that converts sunlight into electricity. A *residential PV system* (hereafter, "PV system") is a solar-PV system connected to house wiring. During daylight hours, the PV system supplies electricity to the house. An electrical utility company supplies electricity to the house at night.

A 5-kilowatt (KW) PV system can cost as little as \$20,000; a 10-KW system, \$40,000. It can take 15 or more years to recover your initial investment in the system through electricity-bill savings (the "payback period").

To decide whether to install a net-metering solar-PV system at your site, you should consider what:

1. objectives you have for your PV system.
2. the terms and conditions of the net-metering agreement(s) available to you are.
3. array size is required for your system, and where to locate ("site") the array
4. tax credits are available to you.
5. warranty the supplier/installer of your PV system, or your homeowner's insurance policy, provides for your system.

Reputable full-service PV vendors can help you assess (1)-(5). Ask a potential PV vendor for the names of customers who can recommend that firm.

Let's look at (1) – (5) in turn.

1. *What are your objectives in installing a PV system?* Purchasers of PV systems typically cite two (partially competing) objectives in installing a PV system: (a) minimizing the payback period while reducing the production of CO₂ created by electrical utilities that burn fossil fuel, and (b) minimizing the production of CO₂ associated with the electricity you would have to buy from your electrical utility company if you did not have a PV system.

2. *Net-metering agreement.* In *net-metering agreements* your electrical utility company agrees to credit you for electricity you generate with your solar-PV system.. Many net-metering agreements will credit your account *up to the amount of electricity you actually use in a month* at a higher rate (e.g., 13 cents per kilowatt-hour (KWH)), and credit your account at a much lower rate (e.g., three cents per KWH) for energy your PV system generates above the amount you consume in that month. Many net-metering arrangements credit only per billing cycle (e.g., once per month), then *reset your credit to zero for the next billing cycle*. Most net metering

agreements charge you a fee for the use of poles, wires, and administration of their system. That non-electricity fee can average \$30 per month

3. *Sizing and siting.* The amount of electricity produced by a PV system varies by the number of hours per day that sunlight falls on the PV array and by the position of the sun with respect to the array during the day. The optimal size of the array depends on your objective. If you are trying to minimize the CO₂ production associated with the electricity you obtain from a natural-gas, or coal, -burning electric utility, you should try to size your array to supply 100% of the electricity you will consume in a year at your site. If your objective is to minimize the time it takes for you to recover the cost of installing that system while reducing CO₂ production, you should size the PV array to achieve that objective. In many areas of the US, minimizing the time it takes for you to recover the cost of installing a PV system while reducing CO₂ production will result in a system that supplies 40% or less of the total electricity you consume in a year.

Ideally, your solar array should be placed where it receives direct sunlight from dawn to dusk. But many residential sites are shaded part of each day, so this ideal cannot be realized. Depending on whether the site you choose is shaded part of the day, you may have to increase the size of the array to meet your objectives. As a rule of thumb, as of April 2022, in the contiguous 48 US states commercially produced residential PV systems need an average of five hours of direct sunlight per day across the entire array.

4. *Tax credits.* As of April 2022, the US Government will give you a 26% tax credit for your cost of installing a solar PV system. Tax credits do not reduce your total expenses for a PV system, but they can reduce your income tax. To obtain a tax credit, you must show that you installed a PV system at price X, then apply for the associated tax credit as part of your tax filing.

5. *Warranty.* Some PV system vendors provide a warranty on their systems. Analyze the terms and conditions of these warranties carefully. What happens to the warranty if the local office of your installer goes out of business? In addition, contact the insurance company that carries your homeowner's policy to determine under what, if any, conditions that policy covers PV systems.

For more information, see <https://www.energy.gov/energysaver/planning-home-solar-electric-system> .

Jack Horner is a systems engineer. Tony Pawlicki made several suggestions that helped to improve the readability of this column.