Science You Can Use

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Dear Science: I'm trying to determine whether I will save money on my electrical bill if I install a solar photovoltaic (PV) system at my residence. How do I make this assessment? -- Buck R.

Dear Buck: For the sake of the analysis, let's conservatively assume that

A. energy prices remain where they are today
B. there is no inflation
C. there is no solar tax credit

Although prices and inflation will almost surely increase over the life of a solar PV system, and as of October 2022 there is a 30% solar tax credit, assuming none of these is the case will avoid unproductive speculation about what the future will hold.

There are least two ways to analyze whether you will save money if you install a solar PV system at your residence: the payback-period method, and the return-on-investment method. Let's look at each in turn.

Payback-period method. The payback-period method estimates how long it will take the savings you realize in your electrical bill to equal what you paid for your system. To use this method, you will need to get an estimate of how much (if anything) a solar PV system for your site will save each year. In order to do this, you will need the help of a reputable solar PV installer and maintainer. (To determine whether a candidate seller is reputable, ask for references and note whether the candidate seller has been in business in your region for at least five years.)

The candidate solar PV seller will visit your site and estimate the price of a system that will minimize your payback period. Their calculations will likely assume that

1. energy prices will increase yearly at some definite rate (e.g., 5%, year-over-year)
2. inflation will be something like the long-term historical average (e.g., 3%, year-over-year)
3. a solar PV tax credit (e.g., 30%) applies to your purchase.

Under assumptions (1) – (3), the PV system's seller's estimate is likely to predict a payback period of 10 – 15 years. The seller's payback period estimate will likely include a payback estimate for each year for the entire payback period; if not, ask for such a schedule. Divide the gross price of the system by the price of the electricity the candidate seller's estimate predicts you will save in the first year. The result is a conservative estimate of your payback period.

Payback period example. Suppose the candidate seller's estimate of the gross price (i.e., the price without a solar tax credit) of a system for your house is $30,000, and the estimate says that you will save $1500 in energy prices in the first year of operation. Suppose further that you do

not borrow money to pay for the system. Then a conservative estimate of your payback period is ($30,000 divided by $1500 per year savings =) 20 years.

If you borrow money to pay for this system, add the interest you will have to pay on that loan to the gross price of the system. The cost of borrowing money may be more than you will save in the cost of electricity. If you borrow $30,000 at an average of 7% interest per year (on the original principal) to buy the system in the example above, you will have to pay an average of $2,100 interest each year. You would lose money every year in that scheme.

ROI method. The ROI method treats your investment in a solar PV system as if it were a deposit in a savings account (but see caveat below). To use this method, divide the amount you estimate you will save on your electrical bill in a year by the gross price of the system.

ROI example. Assume the example above. Then the return on investment is ($1500 in savings divided by $30,000 =) 5% per year. As of October 2022, a 5% return on investment would be at least five times the return on investment you could make on a typical savings account.

There are other ways to compute what a solar PV system can save. Some of these alternatives count the solar tax credit as savings or return on investment, for example.

There is an important caveat to all of the above. At present, solar PV systems have an estimated lifetime of about 40 years. At the end of that lifetime, you will have to replace the solar panels and likely, a device called an inverter. The price of replacing those components is likely to be about the price of the original system. If the payback period is greater than the system lifetime, the system will never pay back what you paid for it. If the payback period of your system is less than the system lifetime, then any amount you save on your electrical bill between the end of the payback period and the end of the system's lifetime is true savings compared to what you would have paid in electrical bills without the system.

For further information, see https://www.eia.gov/energyexplained/solar/photovoltaics-and-electricity.php and https://pvwatts.nrel.gov/pvwatts.php .

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