

does it pay?

Figuring the financial value of a solar or wind energy system.

By Andy Black

How long will it take for your new solar or wind electric system to pay for itself? That depends on your local climate, utility rates and incentives. In sunny or windy states with expensive electricity, the payback is faster than in calm or misty states where power is relatively cheap.

The most important factors for making solar an attractive investment include high electric rates, financial incentives, net-metering policies and good sunlight (available in almost all of the continental United States).

Where net-metering laws exist, solar energy offsets the retail cost of the electricity generated. In some regions, solar systems are allowed to operate on a time-of-use rate schedule, enabling users to sell back electricity to the utility at peak rates, which can be even more valuable. Time-of-use rates vary electricity price by time of day, with higher rates occurring during times of shortage (for instance, when air-conditioning loads are high), when the utility must pay more to purchase electricity from generators. Solar tends to produce electricity during these higher rate periods.

Direct incentives can include tax benefits such as credits or depreciation. The most celebrated recent incentive is the federal tax credit for solar systems that went into effect Jan. 1, 2006. The credit is for 30 percent of the system cost, up to \$2,000 for residential systems (there's no cap on commercial credits). For photovoltaic (PV) systems, that typically means a \$2,000 credit on the purchaser's tax return for the year the system was installed. This credit can be coupled with state, local and utility incentives. Consult a certified tax advisor to check the applicability of incentives to your situation. The federal tax credit is due to expire on Dec. 31, but advocates are working hard to get Congress to extend it.

A big factor in the economics is inflation in electric rates. Solar and wind are inflation-protected investments because they offset electricity costs at the current prevailing rate. As rates rise, the owner saves even more.

New forms of direct incentives are performance-based incentives (PBI) and renewable energy credits (RECs, or "green tags"). Both incentives are paid on a per-kilowatt-hour basis. Unlike rebates, they don't help reduce the up-front cost, but they do increase the cash payments the owner receives after commissioning the system. Where available, payments can be as much as 39 cents per kilowatt-hour for five years for the PBI, and between 1 cent a 5 cents per kilowatt-hour for a five-year contract on RECs if the system is large enough (usually at least 10 kW). Because these payments often can be combined with net-metering value, the PV system is capable of garnering substantial revenue per kilowatt-hour generated, where favorable policies exist.

Determining the payback

Several useful ways to measure the economic value of a generating system: compound annual rate of return, cash flow and increase in property resale value. In strong economic cases, the annual returns will be more than 10 percent, the cash flow positive and the increase in resale value greater than system cost.

Compound annual rate of return, or CARR, is another term for interest-rate yield — a way of comparing one investment to another. For example, a savings account might pay 1 percent interest and the long-term stock

market has paid about 10.5 percent. For more detail on the following calculations, see the articles at ongrid.net/papers.

The cash flow will be positive, either immediately or within a few years, for many homeowners who finance their solar systems using home equity loans.

The cash-flow calculation compares the estimated savings on the electric bill to the cost of the loan. Monthly loan cost is the principal plus interest payment required to pay off the loan, less any tax savings. In the case of "deductible" loans, such as home equity-based loans, the interest is usually tax-deductible and thus the loan effectively costs less. Home equity loans are also excellent sources of funds because interest rates on real estate-secured loans are relatively low and payment terms can be long.

Inflation affects rates and thus effectively increases the savings from a generating system over time. Inflation doesn't affect loan rates, particularly with fixed-rate loans. Hence, as electric rates rise, the savings grows, but the cost of the loan stays relatively constant (it rises a little over time as the interest portion of the payment declines and the tax deductibility declines).

An increase in property resale value occurs in homes with generating systems because of the reduced utility operating costs. According to a 1998 *Appraisal Journal* article by Rick Nevin and Gregory Watson, a home's value increases \$20,000 for every \$1,000 reduction in annual operating costs from energy efficiency. The rationale is that the money from the reduction in utility bills can be spent on a larger mortgage with no net change in the monthly cost of ownership. Nevin and Watson calculate that historic mortgage costs have an after-tax effective rate of about 5 percent. If \$1,000 of reduce operating costs is put toward debt service at 5 percent, it can support an additional \$20,000 of debt. To the borrower, total monthly cost of home ownership is identical. Instead of paying the utility, the homeowner pays the bank, but the total cost is unchanged.

Generating systems appreciate over time, rather than depreciate as they age. This is because of the increasing annual saving as electric rates rise. All the calculations in this article assume that electric rate inflation will be 5 percent. If so, the generating system will save 5 percent more value each successive year, and thus gain from the 20:1 multiplier effect. The property resale value will then increase 5 percent per year compounded.

This appreciation cannot continue forever, as the increase in resale value runs into the second limit, which relates to the system's remaining life. PV modules are warranted at 25 years to work at 80 percent of their new capability. Calculations of long-term value should take this into account. ⚙️

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Payback Calculators and Resources

Database of State Incentives for Renewable Energy and Efficiency
dsireusa.org

The Clean Power Estimator
consumerenergycenter.org/renewables/estimator

FindSolar Estimator
findsolar.com/index.php?page=rightforme

OnGrid Solar Financial Analysis Calculator
ongrid.net/payback

QuickQuotes
clean-power.com/quickquotes

PV Watts
rredc.nrel.gov/solar/codes_algs/PVWATTS

RETSscreen
restscreen.net

Solar Energy Industries Association Guide to Federal Tax Incentives
seia.org/manualdownload.php