Energy & Simple Financial Payback Time

For Photovoltaic Modules (Solar Panels)

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Energy Payback Time

Energy Payback Time (EPBT) measures how long it takes for a photovoltaic (PV) module to produce the same amount of energy (output) that it took to manufacture it (DOE, 2004). Energy input required to produce PV cells varies based on extraction of raw materials, type of PV cell manufactured, transportation, maintenance, frame and array support, and module size and efficiency (Battisti and Corrado, 2005). EPBT for PV cells has been calculated to range from 1 to 5 years depending on the type of PV cell chosen (see figure 1 from DOE, 2004) and installation location (Knapp and Jester, 2010; Battisti and Corrado, 2005; DOE, 2004). EPBT for commercial customers is comparable to residential despite commercial installations being larger and requiring greater energy input due to increased power generating capabilities, which offset increased, upfront energy investments.

Simple Financial Payback Time

The financial breakeven point for residential customers ranges between 10-20 years depending on a number of variables from net/dual metering rules, which require utility companies to allow electric meters to spin forward and backward, to tax incentives, increase in property value, and the longevity of PV power systems (see Novinson, 2010; Vickerman, 2007).

Tennessee Valley Payback Time

According to DOE (2004), the average U.S. household uses 830 kWh per month and a system that meets half of this demand (415 kWh/month) has an average EPBT of 2 years. Using this information, TVA's Generation Partners recommends installing a 4.0 kW system (based on an average 14.5% capacity factor). Thus, a residential customer who installs such system would, on average, produce 4,500 kWh annually, which is 126 MWh of clean energy over the typical 25-year life span of a PV system (see Figure 2 from DOE, 2004).

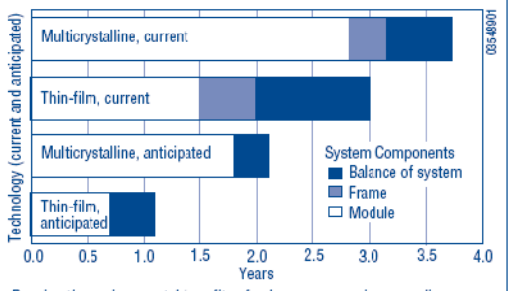
The 4.0 kW system would cost between $25,000 and $32,000 before incentives. Currently in Tennessee, residential customers are eligible for a one-time $1000 credit towards installation and a 30% tax credit from the federal government. This would reduce the initial start-up costs by $8,500 to $10,600, so the system cost with incentives applied is between $16,500 and $21,400. Along with the rebate and tax credit, residential customers will also receive generation credits for a guaranteed 10 years from the Generation Partners[SM] Program at the retail rate plus $0.12 per kWh added to the grid. This would save a Valley resident about $900 on their annual utility bill, ***if maintained properly***, and further reduce the cost of the PV system over time. The financial payback time (FPBT) would be roughly 19 years and have a 25 year return on investment of about 50%.

Concluding Remarks

Generating electricity through solar power reduces the emission of GHGs and other air pollutants. According to the DOE (2004), for every 1,000 kWh of electricity generated using solar power yields an 8 pound reduction in sulfur dioxide emissions, a 5 pound reduction in nitrogen oxides and 1,400 pound reduction in carbon dioxide, on average. DOE (2004) further estimates that a PV system with a 2 year EPBT will save more than 1000 lbs of sulfur dioxide, 660 tons of nitrogen oxides, and 100 tons of carbon dioxide during its typical life-span.

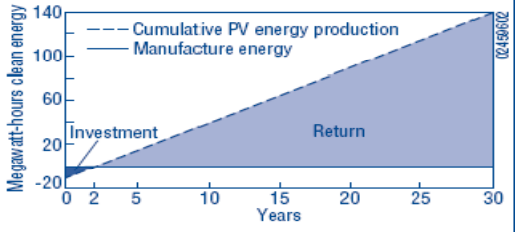
Supporting Information

Figure 1. Energy Payback for Rooftop PV Systems

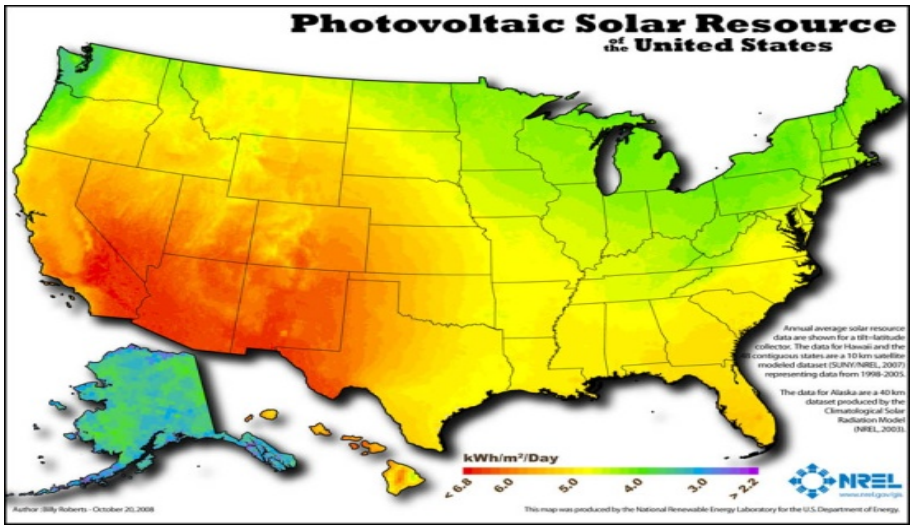


Reaping the environmental benefits of solar energy requires spending energy to make the PV system. But as this graphic shows, the investment is small. Assuming 30-year system life, PV systems will provide a net gain of 26 to 29 years of pollution-free and greenhouse-gas-free electrical generation.

Figure 2. Cumulative Net Clean Energy Payoff



PV systems can repay their energy investment in about 2 years. During its 28 remaining years of assumed operation, a PV system that meets half of an average household's electrical use would eliminate half a ton of sulfur dioxide and one-third of a ton of nitrogen-oxides pollution. The carbon-dioxide emissions avoided would offset the operation of two cars for those 28 years.



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