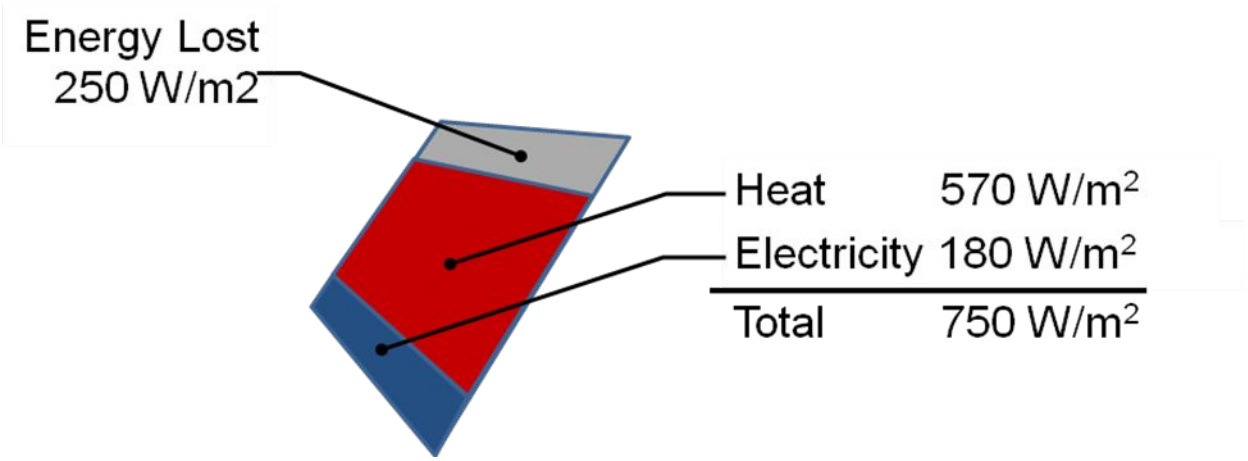
Hybrid Economics

Hybrid solar energy systems capture over 3 times more of the sun's energy than flat plate PV systems. The diagram below shows a square meter of hybrid collector. Most hybrids use mirrors to concentrate sunlight so the square meter shown is the mirror area.

Concentrated sunlight falls on the hybrid's absorber where – like a flat plate PV collector – solar energy is converted to electricity. As in a flat plate PV panel, less than 20% of the sun's energy turns into electrical energy. But in a hybrid, most of the "lost heat" is also captured. In addition to electricity, most hybrids capture more than 50% of the sun's energy as heat. All told, that's 75% of the energy falling on a square meter instead of just 20%.

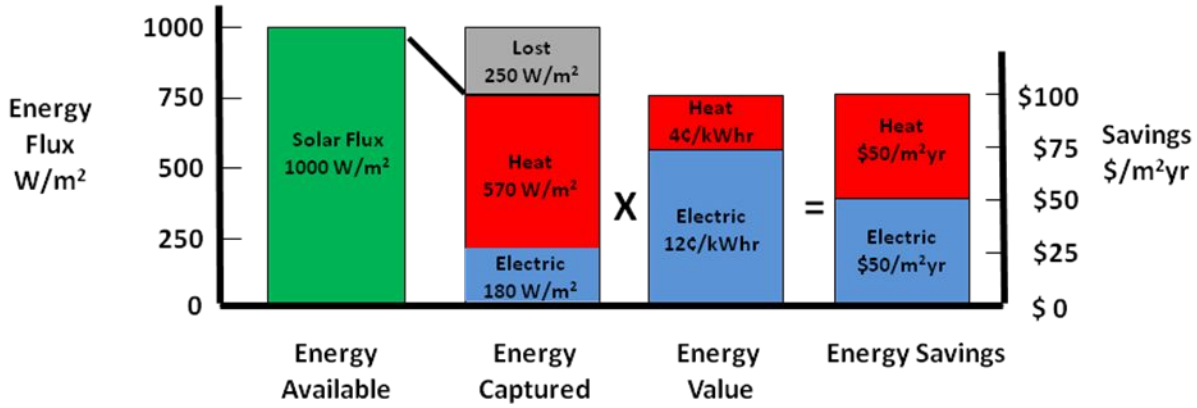
The energy captured by a typical hybrid collector is shown below. Of the 1000 W of solar energy falling on it, 180 W are converted to electricity and 570 W are converted to heat. Only 250 W of energy is lost energy instead of 820 W. It's that lost energy that hybrids capture that makes them so much more efficient than flat plate PV panels.



The payback of a hybrid panel is its cost divided by its savings per year. While the cost is more or less fixed, the savings per year depends on the utility price of electricity. In most of the U.S., utility electricity costs 12¢ (€0.09) for each kilowatt hour of electricity used. Some electricity is more expensive. In California, houses that use twice the average amount of electricity pay 22¢ (€0.16) per kilowatt hour. In New York State, the average utility rate is 17¢ (€0.13) per kilowatt hour. Electricity from a small generator in rural Africa is even more: 35¢ (€0.26) per kilowatt hour.

In the chart below, savings are calculated for the hybrid's heat and electrical energy. Beginning with the 1000 Watts/m^2 available from the sun, each square meter of collector converts 180 Watts/m^2 to electricity, just as in flat plate PV (in blue). Multiplying that by the price of electricity (12¢ (€0.09)/kW-hr) and the average sunlight hours in the U.S. (6 hrs/day) gives annual energy savings of about \$50/m^2 (€37/m^2) from the electrical energy (in blue).

In addition, heat contributes to the savings. If the heat captured is 570 Watts/m^2 (in red) then that is multiplied by the price of heat (4¢ (€0.03)/kW-hr) and the average sunlight hours to give annual savings of an additional \$50/m^2 (€37/m^2) from the heat energy (in blue). Combined, the hybrid doubles the savings of a solar panel.



Notice that a hybrid doesn't produce any more sunlight. Rather, it makes better use of what is available. Instead of throwing away over 80% of the sun's energy, a hybrid uses common heat transfer practices to save that heat for useful purposes.