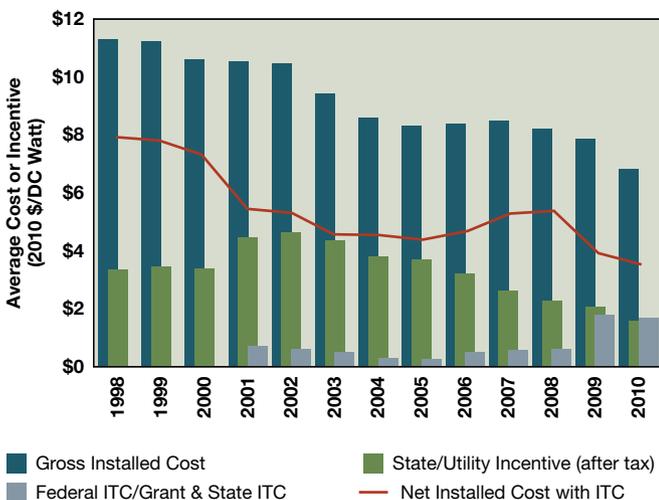


# Plummeting PV Costs

The installed cost of non-utility PV systems dropped 17% from 2009 to 2010, according to a report by the Lawrence Berkeley National Laboratory. The capacity-weighted average installed cost was about \$6.20 per watt in 2010, down from \$10 per watt a decade before. During the first half of 2011, there was an additional 11% decline from 2010. The report examined small (less than 10 kW) to large (more than 1,000 kW) residential and commercial PV systems as well as utility-scale systems. Other major findings:

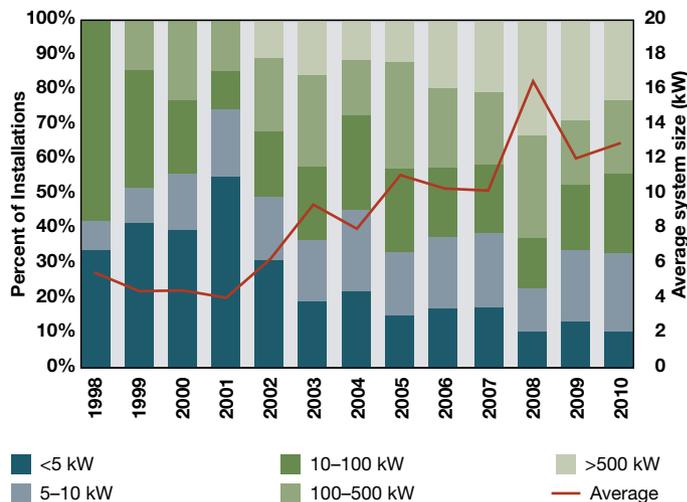
- **Wholesale module prices fell about \$1.40 per watt** from 2008 through 2010, and were still falling in 2011. The largest factor for installed cost declines was lower module prices, due to expanding production.
- **Nonmodule and noninverter costs dropped about \$0.60 per watt** from 2009 to 2010. All other components constitute the “balance of system,” which includes mounting hardware, labor, permits and fees, shipping, overhead, taxes, and installer profit. Inverter costs have stayed fairly level from 2007 through 2010, and the lower costs are attributable to other factors.
- **Systems smaller than 2 kW averaged \$9.80 per watt in 2010**, while those greater than 1,000 kW (large commercial systems) averaged \$5.20 per watt—47% less. Economies of scale matter, though it’s not linear. The cost drops significantly up to a 5 kW system size and then doesn’t significantly drop again until a 100 kW system size.

## Looking Beyond Net Costs



State/utility subsidies and gross installed costs have been going down, while federal incentives have been increasing.

## System Size Distribution



Average PV system sizes are rising.

- **In 2010, overall average installation costs declined** despite reduced average state and utility cash incentives. State and utility incentives continue their general decline. Partially offsetting these decreased subsidies was an increased federal subsidy.
- **Very small systems cost less in new construction** than residential retrofits. Economy of scope matters as well. For small systems, shared transaction and labor costs between the PV installation and other elements of new home construction had cost savings between about \$0.70 per watt (2 to 3 kW systems) and \$1.40 per watt (1 to 2 kW systems) compared to residential retrofits. However, with larger—but still small ( $\leq 10$  kW)—systems, there were not significantly reduced costs as system size increased.
- **90% of the projects analyzed were 10 kW or less**, but they represented only 34% of total installed capacity. It takes a large number of rooftop systems to equal the capacity of one utility-scale PV plant.
- **Modules with midrange (around 15%) efficiencies** achieved the lowest installed system costs in 2010. If you have the space, choose modules that are the most cost-efficient (\$/W) over those that are the most efficient.
- **U.S. PV installations have grown exponentially**, but PV-generated energy still only contributes about 1% to the U.S. energy mix.

—Andy Kerr

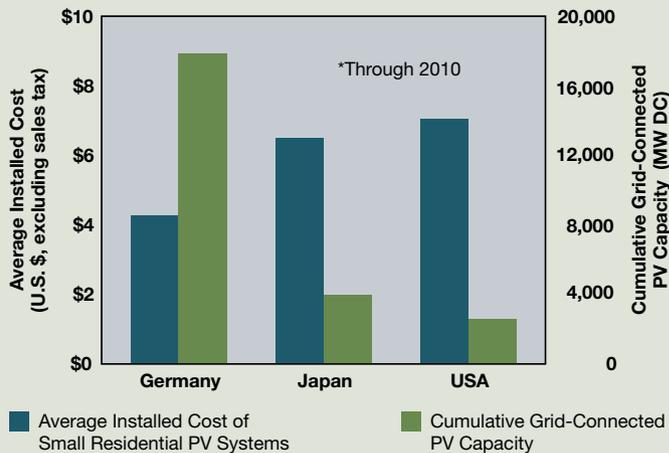
## It's Attitude More than Latitude

Berlin, Germany, is further north than Saskatoon, Saskatchewan, Canada. Comparatively, the overcast over Hanover makes Seattle seem sunny. Yet, in 2010, according to the International Energy Agency, Germany installed 7,411 megawatts (MW) of PV capacity, while Japan, at 991 MW, barely surpassed the United States (918 MW). Per person, Germany has 212.5 W of installed capacity, with Japan at 28.3 and the United States at 8.1.

The primary German PV subsidy is the feed-in tariff (FIT), a guaranteed purchase price that the utility must pay for a specified number of years. That certain future income attracts investors today.

The graph (at right), however, which doesn't factor in any FITs, shows that the upfront installed cost in Germany is significantly lower than in the United States or Japan. The data for Germany understates the German cost as it is an average of the 2009 (\$4.70/W) and 2010 (\$3.70/W) figures.

### System Costs Compared



Data courtesy: Tracking the Sun IV, Lawrence Berkeley National Laboratory.

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