Toward Grid Parity

What will it take for PV-generated electricity to be price-competitive with traditional fossil-fuel based electricity?

In certain applications or with some financial incentives, PV electricity is at or near grid parity: when the solar electricity costs are equal to or lower than the residential retail electricity rate. However, to reach widespread grid parity, the cost of installing and operating PV systems still must be reduced to become competitive *without* subsidies.

PV-made electricity must compete against very cheap electricity from natural gas turbines. "When it gets to $1 a watt, solar will be the same cost as natural gas energy, without subsidy," said Department of Energy Secretary Steven Chu.

"Significant reductions are still required to make it a true 'game-changer,'" says the Rocky Mountain Institute (RMI), an energy-efficiency think tank, in its report "Achieving Low-Cost Solar PV." PV modules make up about half of a PV system's cost, and module prices have been falling rapidly (see "Plummeting PV Costs" in *HP148*). Significant cost reductions are also being seen with PV components, labor, and permits.

Among many aspects for PV electricity to reach parity, the *SunShot Vision Study* by the U.S. Department of Energy examines balance-of-system (BOS) costs. The study divides BOS cost-reducing strategies into two classes:

Hard. Better supply chains; high-voltage systems; improved mounting integration for modules and roofs; innovative materials; standardized/packaged system designs; and building-integrated PV.

Soft. Permit and interconnection streamlining; better software and databases; removing barriers (policy, regulatory, and utility); workforce development; creative financing approaches; development of best practices; and reducing supply chain margins, while increasing overall profits.

BOS costs are decreasing, but the SunShot Initiative seeks to push them much lower, and faster than market evolution would normally, by directing government research and development that supports cost-saving technologies and processes, encouraging standardized and streamlined permitting by local jurisdictions, etc. In 2013, BOS costs are forecast to decrease about $0.29 per watt from 2010 amounts, according to GTM Research, a market analysis firm.

In 2010, RMI reported that near-term cost reductions could approach 50% (or $0.60 to $0.90 per watt) below current best practices, and that such reductions are necessary to achieve the wide-scale application of PV systems. RMI identified that standardization and integration are key to lowering system costs. Here are a few of its recommendations:

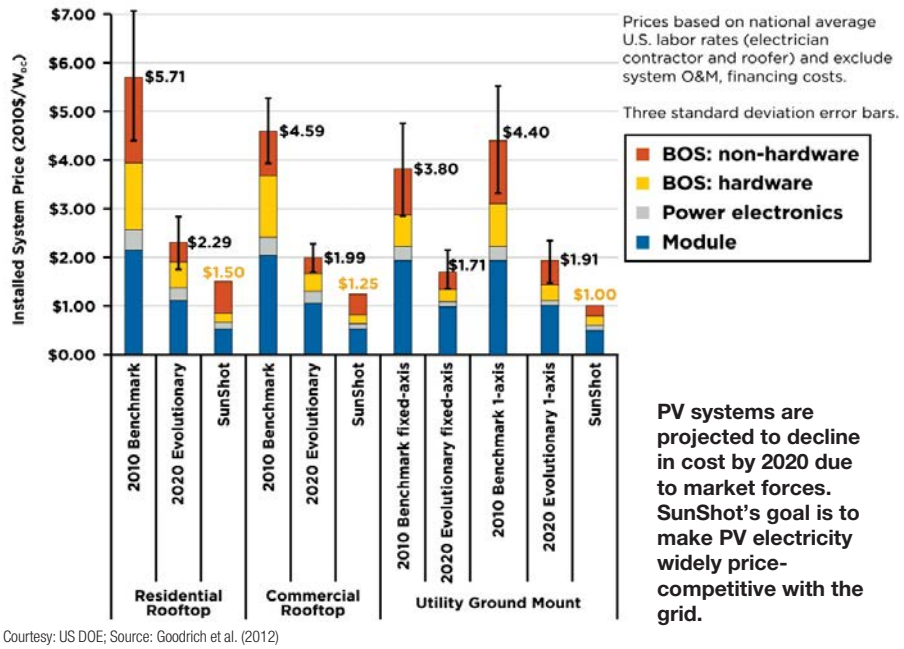
Standardize PV module physical dimensions. Nonstandard sizes mean higher rack and installation costs.

Integrate microinverters into PV modules. It's faster and cheaper to combine them at the time and place of manufacture than connect them during installation.

Rethink electrical system architectures. Higher voltages mean greater efficiencies and use of smaller, less expensive wire.

Design for, not against, the wind. A solid array at an optimum sun angle may have huge wind-loading stresses.

Installed PV System Prices: 2010 Benchmark, Projected 2020 Evolutionary, and 2020 SunShot Targe



PV systems are projected to decline in cost by 2020 due to market forces. SunShot's goal is to make PV electricity widely price-competitive with the grid.

Courtesy: US DOE; Source: Goodrich et al. (2012)

Reducing the module angle to minimize drag and leaving gaps between the modules to let the wind pass can significantly reduce engineering and rack requirements, reducing cost.

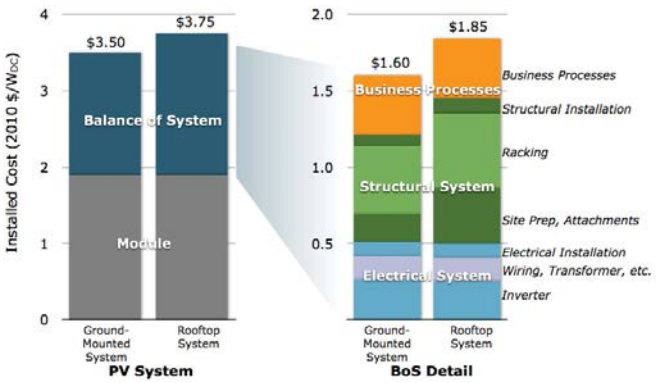
Streamline and simplify permits. With increased standardization of systems and components, local jurisdictions will be more willing to improve their permitting processes. Permitting costs are a large BOS component and can be dramatically reduced without compromising safety.

A report by Sunrun, a residential PV leasing company, found that local permit costs averaged $2,516 per residential installation (about $0.50 per watt). Sunrun argues for standardized, streamlined, and consistent permitting, while ensuring safety by meeting code requirements through the widespread adoption of policies recommended by Solar America Board for Costs and Standards, a project funded by the U.S. Department of Energy.

John Farrell of the Institute for Local Self-Reliance estimates that by achieving all of these BOS recommendations—and with just the federal tax credit—PV-generated electricity could be price-competitive with, or even less than, average retail electricity rates in 13 of the 20 largest U.S. metropolitan areas. With time-of-use metering (higher utility rates when demand is high—such as during hot summer days), PV-generated electricity could be less than the average grid electricity price in 19 of 20 metropolitan areas.

—Andy Kerr

Cost Breakdown of Conventional U.S. PV Systems ca. 2010



Courtesy: Rocky Mountain Institute

Not included in the above breakdown is the cost of the land upon which a ground-mounted system rests. Roofs are readily available, so the land cost of roof-mounted PV systems is effectively zero.