

NREL Study of Fielded PV Systems Demonstrates PV Reliability

Highlights in
Research & Development

Photovoltaic module quality has remained high even as module prices have declined.

Scientists at the National Renewable Energy Laboratory (NREL) have analyzed the annual performance data from almost 50,000 photovoltaic (PV) systems that total 1.7 gigawatts of capacity installed in the United States from 2009 to 2012. The overall conclusion is that the vast majority performed as expected.

Since 2009, the price of PV modules has fallen dramatically—and with this drop has come concerns about whether the quality of modules and systems has decreased significantly. However, NREL's analysis of Section 1603 of the American Recovery and Reinvestment Tax Act of field performance, reliability, and durability will enable investors and consumers to quantitatively assess any risk of subpar performance.

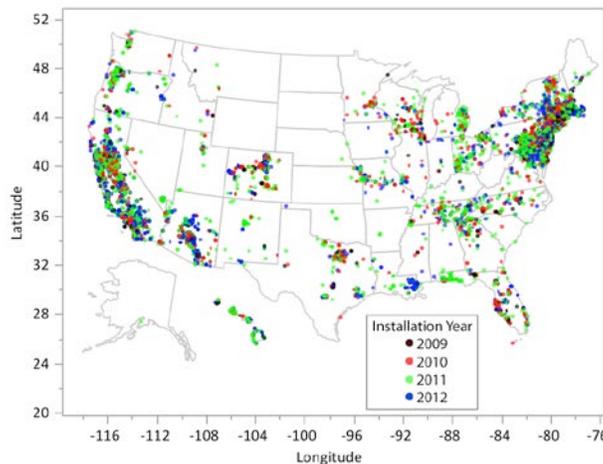
Significant findings include the following:

- About 90% of the systems with no reported issues produced more than 90% of the predicted electricity.
- Between 2% and 4% of all systems reported problems that caused some underperformance.
- Delays and interconnection issues dominated project-related issues—particularly in the first year—but were reported in less than 0.5% of all systems.
- Hardware-related issues were dominated by inverter problems (<0.4%) and unspecified repairs.
- Underperforming modules were reported in less than 0.1% of all systems.
- Many reliability categories showed a significant decrease in occurrence from Year 1 to subsequent years. This result emphasizes the need for higher-quality installations, as well as for improved standards development.
- Systems that used the NREL tool PVWatts to generate the predicted production showed significant overproduction, suggesting a more accurate default derate value of about 0.83.
- The data were consistent with the assumption of historical degradation rates of about 0.5%–1% per year, but not significantly higher.

In summary, NREL found that the vast majority of PV systems perform well despite recent declines in PV module prices.

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Reference: Jordan, D.C.; Kurtz, S.R. (2014). "Field Performance of 1.7 Gigawatts of Photovoltaic Systems." *IEEE J. Photovoltaics*, forthcoming.



Geographical distribution of analyzed installations colored by the year of installation.

Key Research Results

Achievement

NREL analyzed annual performance data from almost 50,000 PV systems—representing 1.7 gigawatts of capacity installed domestically from 2009 to 2012.

Key Result

NREL found that PV module price decline did not lead to quality decline. The majority of systems perform as expected, with no massive failures and no excessive degradation.

Potential Impact

NREL's careful analysis of field performance, reliability, and durability allows investors and consumers to quantitatively assess the risk of poor performance.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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