



PHOTOVOLTAICS

Measuring multijunction cell efficiency using an X25 Solar Simulator. Photo by Dennis Schroeder, NREL 48890

Setting the Bar for Device Performance of Photovoltaic Cells and Modules

Cutting-edge photovoltaic (PV) research and development benefits from NREL's world-record accuracy in device performance measurements. NREL is a global leader in providing PV calibration services to help control manufacturing quality, assess degradation rates, and develop new technologies.

The Challenges

High-accuracy, certified calibrations of PV device performance are crucial for PV researchers, manufacturers, and end users. PV module manufacturers and PV cell and materials researchers rely on calibration traceability to accredited test labs for reliable performance measurements of their devices. And in today's PV industry, manufacturers cannot afford to give up any profit to less-than-optimal calibrations: the financial impact of an additional 1% uncertainty in module power runs in the millions of dollars for gigawatt-scale production at current module sales prices.

Our Capabilities

NREL can measure PV devices of almost any configuration/architecture and underlying conversion technology. Such calibrations are beyond the scope of most in-house PV measurement capabilities. Therefore,

Success Stories

- One of only four laboratories worldwide certified to do primary reference cell calibrations.
- Have developed methods for repeatable high-accuracy calibration of emerging technology devices such as perovskites.
- Have developed the "module self-reference" procedure for obtaining extremely high-accuracy calibrations of commercial-sized modules.

Partners

- We work with industry and academic partners worldwide, including the major U.S. PV manufacturers.



NREL's robust calibration measurements serve a vital need for customers worldwide.

We provide high-accuracy performance calibrations of commercial and research PV cells and modules following ASTM E44 and IEC 60904 standards. Our extremely low measurement uncertainties (listed below) place NREL among the most accurate laboratories in the world for PV performance calibration. Such accuracy contributes to improved bankability for investors with respect to the manufacture of solar devices. In addition, for time-critical projects, we can provide results within less than six weeks.

How We Get There

- We maintain extremely accurate calibrations of PV cells and modules, certified under ISO 9001 and 17025 quality standards.
- We can measure PV devices of almost any size, shape, or type, including emerging technologies and multijunction/multiterminal, bifacial, and concentrator devices.
- Our uncertainty for commercial monocrystalline- and multicrystalline-Si module calibrations is $\pm 1.1\%$ for maximum power and $\pm 0.8\%$ for short-circuit current.
- Our uncertainties for cell calibrations are $\pm 0.4\%$ for primary reference cell current, $\pm 0.6\%$ for secondary reference cell current, and $\pm 0.6\%$ for secondary reference cell power.
- Our in-house capabilities and data analysis are founded on years of development, including establishing much of the foundation for modern PV device measurement and calibration.

Partner With Us

We want to do business with all interested parties. Our website, <https://pvdpc.nrel.gov>, makes calibrating your devices fast and easy—with a turn-around time of six weeks or less.

Contact Us

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Indoor testing of PV modules at NREL. Photo by Nikos Kopidakis