State-of-the-Art Solar Simulator Reduces Measurement Time and Uncertainty

One-Sun Multisource Solar Simulator brings accurate energy-rating predictions that account for the nonlinear behavior of multijunction photovoltaic devices.

The National Renewable Energy Laboratory (NREL) is one of only a few International Organization for Standardization (ISO)-accredited calibration labs in the world for primary and secondary reference cells and modules. As such, it is critical to seek new horizons in developing simulators and measurement methods. Current solar simulators are not well suited for accurately measuring multijunction devices. To set the electrical current to each junction independently, simulators must precisely tune the spectral content with no overlap between the wavelength regions. Current simulators do not have this capability, and the overlaps lead to large measurement uncertainties of ±6%.

In collaboration with LabSphere, NREL scientists have designed and implemented the One-Sun Multisource Solar Simulator (OSMSS), which enables automatic spectral adjustment with nine independent wavelength regions. This fiber-optic simulator allows researchers and developers to set the current to each junction independently, reducing errors relating to spectral effects. NREL also developed proprietary software that allows this fully automated simulator to rapidly "build" a spectrum under which all junctions of a multijunction device are current matched and behave as they would under a reference spectrum.

The OSMSS will reduce the measurement uncertainty for multijunction devices, while significantly reducing the current-voltage measurement time from several days to minutes. These features will enable highly accurate energy-rating predictions that take into account the nonlinear behavior of multijunction photovoltaic devices.

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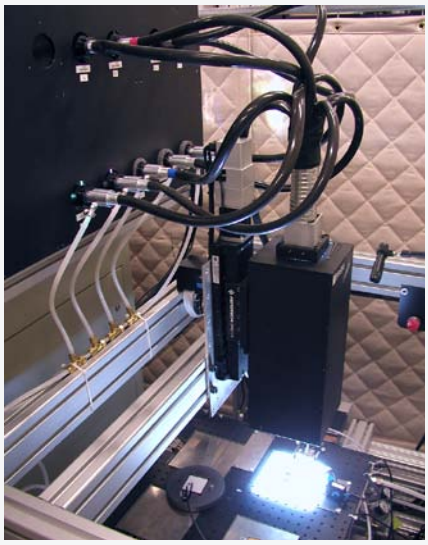

One-Sun Multisource Solar Simulator. Photo by Tom Moriarty, NREL/PIX 20368

Key Research Results

Achievement

NREL and LabSphere designed and implemented a fiber-optic solar simulator that enables automatic spectral adjustment with nine independent wavelength regions.

Key Result

The simulator gives accurate energy-rating predictions that account for the nonlinear behavior of multijunction photovoltaic devices. Researchers and developers can set the current to each junction independently, reducing errors related to spectral effects.

Potential Impact

This new capability will:

- Reduce measurement uncertainty for multijunction devices
- Significantly reduce measurement time from days to minutes.

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