NREL
NATIONAL RENEWABLE ENERGY LABORATORY

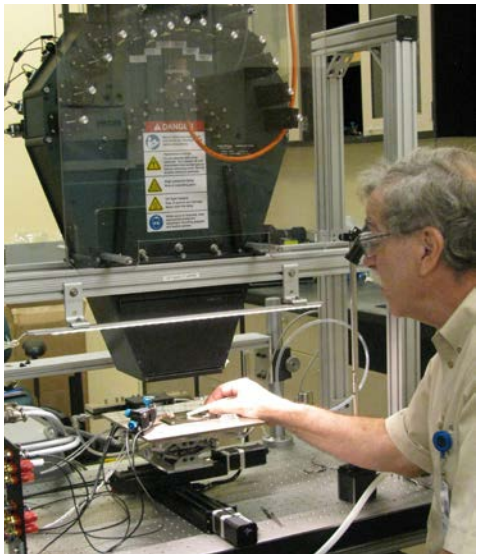
Boosting Accuracy of Testing Multijunction Solar Cells

Highlights in Research and Development

NREL has developed a more precise technology for measuring efficiency of concentrating solar cells, enabling the industry to advance.

Solar researchers have long been unable to reduce an error that occurs during efficiency measurements of triple-absorber, concentrating photovoltaic (CPV) cells—one that is caused by too much spectral irradiance from unfiltered, pulsed xenon solar simulators entering into the bottom subcell during testing.

This condition causes an artificial increase in the measured efficiency. The inaccuracy is significant because concentrator systems manufacturers base their photovoltaic technology choices on these measurements, which if imprecise, can misrepresent the technologies' performance.



An NREL scientist mounts a multijunction cell to be tested in the new Tunable-High Intensity Pulsed Solar Simulator (T-HIPSS). Photo by Karen Atkison, NREL 32649

Researchers from the National Renewable Energy Laboratory's (NREL) Photovoltaic Cell and Module Characterization group, in conjunction with Spectrolab, Inc., have developed a solar cell measurement system, the Spectrolab Model 460 Tunable-High Intensity Pulsed Solar Simulator (T-HIPSS), to mitigate the error. Working with Spectrolab, the researchers requested a customized T-HIPSS 460 for use at NREL. With additional hardware and software modifications, including a custom filter, the researchers developed a version of the T-HIPSS 460 that can be correctly adjusted for state-of-the-art multijunction solar cells.

For researchers in the industry who don't have access to the T-HIPSS 460, NREL has developed an empirical error correction procedure for correcting measurements made with unfiltered simulators. The efficacy of the procedure has been demonstrated by comparing unfiltered efficiency data against data from the new T-HIPSS 460.

By reducing the errors in the efficiency measurements of multijunction solar cells, NREL and Spectrolab are helping concentrator systems companies develop the most efficient—and therefore most cost-effective—devices to manufacture and deploy. This economical approach helps cut the overall costs of producing solar energy and hastens the commercialization of CPV worldwide.

Technical Contact: Keith Emery, *keith.emery@nrel.gov*

References: Osterwald, C. R.; Wanlass, M. W.; Moriarty, T.; Steiner, M. A.; Emery, K. A. (2014). *Effects of Spectral Error in Efficiency Measurements of GaInAs-Based Concentrator Solar Cells*. 26 pp.; NREL/TP-5200-60748. Golden, CO: National Renewable Energy Laboratory, 2014: *http://www.nrel.gov/docs/fy14osti/60748.pdf*.

Osterwald, C. R.; Wanlass, M. W.; Moriarty, T.; Steiner, M. A.; Emery, K. A. (2014). "Empirical Procedure to Correct Concentrator Cell Efficiency Measurement Errors Caused by Unfiltered Xenon Flash Solar Simulators." *http://dx.doi.org/10.1109/pvsc.2014.6925466*

Key Research Results

Achievement

NREL and Spectrolab have created the world's most accurate high-efficiency concentrating photovoltaic cell test bed, and developed procedures for correcting data derived from other systems.

Key Result

NREL significantly improved the accuracy of multijunction solar cell efficiency measurements.

Potential Impact

Reducing measurement errors can help concentrator systems companies make efficient technology choices, improving efficiency throughout the CPV industry and facilitating the growth of commercialization.

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.

15013 Denver West Parkway
Golden, CO 80401
303-275-3000 | www.nrel.gov

NREL/FS-5J00-63381 | January 2015

NREL prints on paper that contains recycled content.