NREL Highlights RESEARCH & DEVELOPMENT

Simulator Developed to Drastically Reduce Time of Multijunction PV Device Efficiency Measurements

NREL's new simulator helps speed up research in the race to improve photovoltaic efficiency.

Scientists at the National Renewable Energy Laboratory (NREL) needed a quick and accurate method to predict energy generated from multijunction photovoltaic (PV) test devices. This method had to take into account the nonlinear behavior of multijunction PV. NREL achieved this by developing the One-Sun Multi-Source Simulator (OSMSS), which reduces the time for this type of reference spectrum efficiency measurement from hours or days to minutes.

The OSMSS is an automated, spectrally adjustable light source that builds a unique simulator spectrum that causes a multijunction PV device to behave as it would under a reference spectrum. This new simulator consists of four light sources separated into nine wavelength bands between 350 and 2,000 nm. The irradiance in each band is adjustable from zero to about 1.5 suns. All bands are recombined via optical fibers and integrating optics to produce a nearly 10 cm x 10 cm uniform spot. The operator simply links the OSMSS to the quantum efficiency data for the test device, and the OSMSS does the rest.

The OSMSS can also determine the power as a function of the spectral irradiance (beyond the reference spectra), total irradiance, and temperature. Major components of the system were built to NREL specification by LabSphere, Inc.

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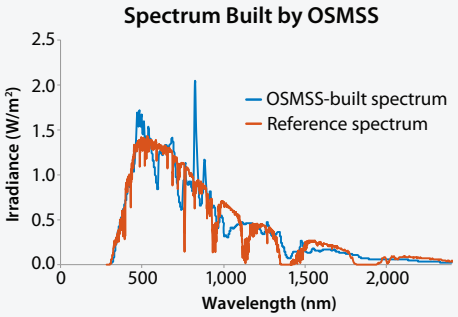

This graph shows an overlay of a reference spectrum (blue) and the spectrum built by the OSMSS (red) to reproduce the effects of that reference spectrum for a particular multijunction device.

Key Research Results

Achievement

NREL developed a new, fully automated tool that rapidly builds a spectrum under which all junctions of a multijunction PV device behave as they would under a reference spectrum. Such a spectrum is essential to properly characterize multijunction devices.

Key Result

The OSMSS reduces the time for building spectra for current vs. voltage measurements from hours or days to minutes. This makes it possible to quickly characterize a multijunction device under many different conditions.

Potential Impact

The OSMSS will be an important tool to help predict the yearly energy output of a multijunction PV device in a particular environment when provided with a range of spectra and temperatures for that location.

NREL
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