

# Press Release

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June 22, 2016  
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## **Fraunhofer ISE CalLab PV Cells Celebrates 30th Jubilee**

### **Standard Reference for Solar Cells**

This year, CalLab PV Cells, the calibration laboratory at the Fraunhofer Institute for Solar Energy Systems ISE, celebrates its 30<sup>th</sup> jubilee. For the past three decades, precisely measured reference solar cells – and for almost 25 years reference modules – have been sent from Freiburg throughout the world. The cell reference provides a measure of comparison for photovoltaics on an international scale, allowing manufacturers and researchers to make efficiency values globally comparable and legally accepted. When the Fraunhofer ISE CalLab PV Cells began operation in 1986, it was the only facility of its kind in Europe. Since then, the lab enjoys international prestige. At CalLab PV Cells today, thirty employees are busy calibrating around 2500 solar cells and 5000 solar modules per year.

“Our ambition is to measure as precisely as possible just how much electricity is converted from sunlight,” says Dr. Jochen Hohl-Ebinger, team leader of CalLab PV Cells. Round robins carried out with the four leading calibration laboratories in the world confirm the high precision of our measurements which ranges between 0.7 and 2 percent. “A short time ago, we visited a renowned calibration laboratory to discuss shadowing by contacting on location,” explains Hohl-Ebinger. “At the end of our discussion, we were able to convince him of our concept!”

Besides highest quality measurements, we assure our clients absolute confidentiality. Although we make use of the in-house expertise at Fraunhofer ISE, we ascertain that no confidential information flows from our labs to them. “In fact, my supervisor first found out that his world record was surpassed while listening to a colleague’s talk at a

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conference, even though the measurements verifying the results were carried out at Callab PV Cells," relates Hohl-Ebinger.

About 90 percent of the contracts come from industry. A manufacturer sends five cells, for example, which are chosen from the production line. After calibrating the cells, 100 copies are made for use in the ongoing production. A year later, the calibration is rechecked.

Almost every measurement sample is different, which necessitates customizing the measurement apparatus and techniques. Each new type of back contacted solar cells, for instance, requires the construction of a new measurement chuck made from massive copper and costs around 15,000 euros. For the manufacturer, however, it's worth the price: The return on investment can be reached within two weeks, if the cell selection becomes 0.5 percent more accurate as a result of the calibration.

Standard cell calibrations start at 470 euros for which measurements of the area, linearity, spectral response and current-voltage characteristics are carried out. Many other measurements, such as temperature dependence, are possible. Besides silicon, all types of organic and inorganic solar cells can be measured at Callab PV Cells. "Together, the three calibration laboratories at Fraunhofer ISE cover the whole spectrum of photovoltaic generators from flat plate or concentrator modules through to sophisticated multi-junction solar cell devices," says Dr. Wilhelm Warta, department head of Characterization and Simulation at Fraunhofer ISE. "Due to increasing demand, we are working on a new laser-based procedure which promises even higher measurement precision."

Calibrating entails comparing a measured test object with a dependably known and unvarying standard reference, which can be traced back through an uninterrupted measurement

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chain to a national standard, that is a "primary reference". In certain cases, e. g. calibrating scales, this is a sovereign task which can be carried out only by institutes under federal or state jurisdiction such as the National Metrology Institute of Germany (PTB). It is then called "calibration". Since its beginnings, CalLab PV Cells has always worked closely with the PTB. The lab is an accredited calibration laboratory, certified to meet different international standards.

The PTB produces so-called "primary reference" cells for Fraunhofer ISE. These are special encapsulated solar cells which have been precisely measured. CalLab PV Cells uses these cells from PTB to produce encapsulated secondary reference cells or unencapsulated work reference cells as standard production cells for industry.

For the standard calibration, the spectral response of the test cell is determined. This demonstrates how the cell behaves under different wavelengths. Given this information, the solar simulator can be set to the internationally accepted standard conditions: The standard intensity of the solar spectrum is 1000 watts per square meter, which is the approximate intensity in Germany at midday in spring. At a cell temperature of 25 degrees Celcius, a current-voltage characteristic is measured, from which the efficiency can be determined.

One of the biggest challenges for CalLab PV Cells is to maintain its highly precise measurements under the daily pressure of high-throughput and a large variety of cell sample types. All processes in CalLab PV Cells are certified, and the apparatuses are tested and maintained on a routine basis. Even changing a lightbulb can trigger a 50 hour process, which includes aging the lamp, adjusting the homogeneity and spectral measurements. The new lamp will be cleared for CalLab PV Cells measurements, only when the apparatus reliably reproduces the same measurement values for the primary reference cells.

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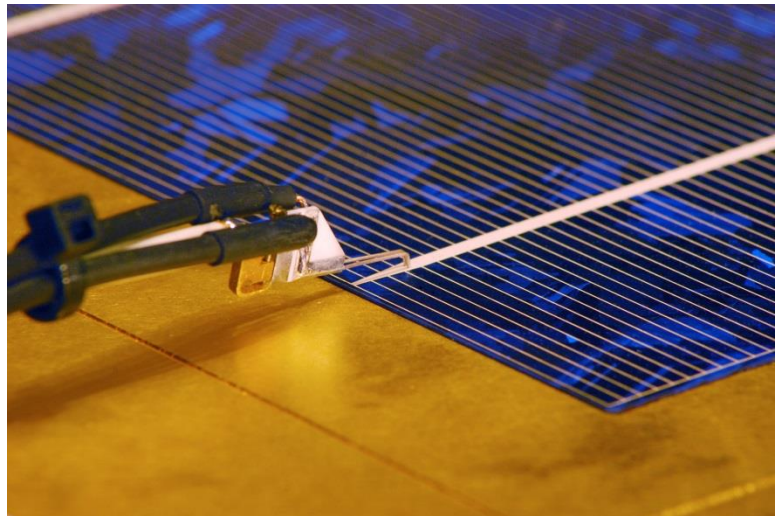
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Fraunhofer ISE Callab PV Cells celebrates its 30<sup>th</sup> Jubilee. ©Fraunhofer ISE

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