

Monitoring Solar Radiation to improve Photovoltaic Efficiency

The limited supply and rising prices of traditional energy sources, together with the increasing awareness of climate change and 'Carbon Footprint' costs, have resulted in rapid development of alternative energy sources, in particular solar and wind energy.



Photovoltaic (PV) is the field of technology and research related to the application of Photovoltaic Cells to convert sunlight directly into electricity. The cost of solar cells, panels and arrays is still rather high, so research into new materials and improvement of efficiency continues. Monitoring the solar radiation plays an important role in analysing both the efficiency of the cells and evaluating optimal locations for 'solar farms'.

Existing meteorological stations are often too far away, so measurement in-situ of the available radiation allows a better understanding of the local (micro) climate. Based on these figures decisions on funding and investment are made for projected renewable power plants.

PV panels are specified under Standard Test Conditions (STC). These conditions are 1000 W/m² of solar radiation, 25 °C, Air Mass 1.5 and no wind. Because these conditions are far from the real world, additional measurements are required to show the PV panel's typical performance. Both pyranometers and reference PV cells are used to measure the radiation. Because pyranometers have standard characteristics they can be used to independently compare all types of PV cells.

When the pyranometer is mounted at the same angle as the PV panel it can be used to calculate the panel's efficiency. Furthermore it can indicate failing panels or cells by a sudden drop of efficiency, whilst a gradual decline of efficiency

will indicate the need for cleaning the panels. Kipp & Zonen CMP pyranometers provide accurate and reliable measurements for PV monitoring.

Pyranometers are also used for checking PV panels and cells under laboratory conditions. Because CMP pyranometers are specified up to 80 °C (or 150 °C for the CM 4) they can monitor the output of the high energy lamps used in solar simulators.



For thermal energy solar concentrators, and sun tracking PV systems, the direct component of the solar radiation is also required. The CHP 1 Pyrheliometer together with a Sun Tracker measures the direct radiation. Sun tracker systems measuring global, direct and diffuse radiation are often used in PV monitoring and research.

Testing of Photovoltaic devices and reference cells using pyranometers is described in IEC 60904, IEC 61215 and IEC 61646 standards. Characterization and calibration of pyranometers is based on ISO 9060 and ISO 9847 ■

SOLAR ENERGY APPLICATIONS

- Solar prospecting for optimum locations
- Radiation check for PV materials research
- Radiation check for thermal systems research
- PV and thermal power plant efficiency check
- Specification and quality testing of PV panels
- Determination of losses in PV and Reference cells
- Tests according to IEC 60904 standards
- Independent comparison of PV panels
- Solar simulator radiation verification