Technical Instruction – **Silicon Irradiance Sensors & Thermopile Pyranometers**

Scope

This technical bulletin discusses the appropriate use of silicon irradiance sensors (also called photovoltaic reference cells) as compared to thermophile pyranometers.

Reference

Pyranometers and Reference Cells: Part 2: What Makes the Most Sense for PV Power Plants? https://www.nrel.gov/docs/fy13osti/56718.pdf

Background

Both thermopile pyranometers and silicon irradiance sensors can be used to measure irradiance, however there are differences between the two that should be noted when selecting which best suits the needs of a particular installation. Accurate performance measurements of photovoltaic (PV) modules are based on two quantities – usable available sunlight and electrical output of the module. Useable sunlight is defined as the light striking a solar cell that can be converted into electricity. It does not include light that is reflected from the glass or spectral light components that cannot be converted by solar cells (e.g., infrared light).

PV modules utilize flat glass, which will reflect a percentage of available sunlight based on its angle of incidence (the angle at which the sunlight strikes the panel). Additionally, solar panels do not respond to all colors or wavelengths of light equally.

Irradiance sensors utilize the same materials and construction as a PV module (glass, cell, encapsulant) resulting in a sensor that closely mimics PV module performance, while exhibiting a matching response with respect to light spectrum absorption and incidence angle. The result is a more accurate measurement of usable sunlight under any environmental condition.

By comparison, thermopile pyranometer construction consists of a black disc covered by a single or double glass (with an airgap), or even quartz dome. This disc absorbs all sunlight that is transmitted through the dome and (due in part to the air gap and spherical shape of the dome) possess an angle of incidence response that differs from a PV module. Thermopile pyranometers also respond to all wavelengths of light transmitted through the dome, including broadband incident sunlight, which while similar is not the same as usable sunlight.

Finally, thermopile pyranometers respond differently to changes in environmental conditions (such as to diffuse light on cloudy days) and take much longer to respond to changes in irradiance than silicon irradiance sensors, whose response time is almost instantaneous.

Conclusion

Irradiance sensors, when used in the plane of array, can more accurately measure PV efficiency in the field than thermopile pyranometers. Use of a silicon irradiance sensor also enables more precise measurement of PV performance, which in turn allows for more accurate detection of deviation from expected performance or PV degradation over time.

Support

For additional information please contact IMT Solar at (716) 276-8466, info@imtsolar.com, or visit us at www.imtsolar.com.