Abstract

A wide variety of sensors are used to monitor the irradiance incident on solar modules to evaluate the performance of photovoltaic (PV) systems. These instruments range from secondary standard pyranometers to photodiode-based pyranometers to reference cells. Although instruments are mounted in the plane of array of the modules a wide range of results have been obtained. Some of these differences have been assumed to come from systematic uncertainties associated with the irradiance sensors. This study is an attempt to quantify these differences by comparing the output of selected thermopile pyranometers to photodiode-based pyranometers and reference cells on a horizontal surface, a fixed tilt surface, and a one-axis tracking surface. This analysis focuses on clear-sky results from two sites with different climatic conditions. Several important features were observed. Photodiode-based pyranometers and reference cells produce widely different results under clear skies, especially at larger angles of incidence even though both instruments are based on measuring the short circuit current of solar cells. The difference is caused by the scattering of light as it passes through the glazing of the reference cell or the diffuser lens of the photodiode-base pyranometer. Both instruments are shown to have similar response to the spectral distribution of the irradiance when compared to the thermopile-based pyranometer that has a response nearly independent of the wavelength of light used by PV modules.

Keywords: *pyranometer, reference cell, one-axis tracking, solar, measurements*