SOLAR IRRADIATION ON VERTICAL SURFACES IN SHAH ALAM

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ABSTRACT

Solar Irradiation on Vertical Surfaces in Shah Alam

The solar irradiation on four vertical surfaces facing North, East, South and West orientations, were measured at Shah Alam. The irradiation on the horizontal surface was also measured simultaneously. The results of the measurements were compared with the simulated data using the Perez Model. The R values (ratio of solar irradiation on a vertical surface to the solar irradiation on the horizontal) for each vertical surface were also determined. A square (cube) box made from plywood with a black painted surface was built to put all the pyranometers used in the experiments. The experimental set-up was placed in an unobstructed location.

Measured data were then processed and analyzed using simple statistical method. Results were compared with a semi-empirical data that were determined using Perez Model based on 10 years measured data taken from Petaling Jaya meteorological station for measurement period from 1980 to 1989. The R values for North, East, South and West produced from the processed data are 0.20, 0.50, 0.16, and 0.21 respectively. Error analyses were done on the R values and were found to be 0.07, 0.06, 0.11 and 0.15 for North, East, South and West orientations respectively.

This study has shown that the Perez Model may still be used for estimating solar radiation in Malaysia if newer models are not created, since the estimation values are almost as close to the measured data.

CHAPTER 1

INTRODUCTION

1.1   Background

Energy from the sun travels to the earth in the form of electromagnetic radiation similar to radio waves, but in a different frequency range. Available solar energy is often expressed in units of energy per unit time per unit area. The amount of energy available from the sun outside the Earth's atmosphere is approximately $1367 W/m^2$. Some of the solar energy is absorbed as it passes through the Earth's atmosphere.

Various different terms are used when dealing with solar radiation. The total specific radiant power, or radiant flux, per area that reaches extraterrestrial receiver surface is called irradiance. When integrating the irradiance over a certain time period it becomes solar irradiation. Which means that, irradiation is the cumulative energy incident on a surface in a given period of time while irradiance is the instantaneous incident energy.

For day lighting purposes, only the visible part of the sunlight is considered. The analogues quantity to the irradiance for visible light is the illuminance. This uses the unit lm/m^2 (lumen/m^2) or lx (lux).