UNIVERSITI TEKNOLOGI MARA

DETERMINATION OF THE SKY CONDITIONS IN SHAH ALAM, MALAYSIA AND MODELLING THE ZENITH LUMINANCE

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of the requirement for the degree of
Master of Science

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

This study aims at classifying the sky at Shah Alam, Malaysia (3° 3.82′N, 101° 29.50′ E). Measurements of sky luminance and sky radiance were made at a chosen location in Shah Alam. The measurements were done by using a sky scanner. This equipment tracked 145 points of the sky hemisphere. The daily measurements were done from 07.30 am to 06.30 pm every day. Field measurements were made during the periods of October to December 2010 and between January, July and August 2011. The luminance and radiance data were converted to illuminance and irradiance. It was also found that the illuminance is proportional to irradiance.The sky ratio and Perez clearness index were then calculated. The sky ratio (SR) was found to be more than 0.6 and the clearness index was between 1.23 and 4.50. Between sky ratio and Perez clearness index method of sky, the value of Perez clearness index is more accurate for sky classification.It was confirmed that the sky at Shah Alam is mostly of the partly cloudy or intermediate type. From the Perez clearness index it was found that most of the sky is 51.38% intermediate (or partly cloudy) sky, 9.72% clear sky and 38.89% cloudy (or overcast) sky. During the measurement period, the maximum mean monthly hourly irradiation was 497 W/m^2 and the maximum mean monthly hourly illuminance exceeded 55klux. The minimum value of illuminance was in the early morning and through evening which is below than 9000 lux while the value of minimum irradiance is below 80 W/m^2.The zenith luminance was plotted by using Kittler's equation. From this plot, it showed that the zenith luminance increased when the solar altitude increased at noon time. Zenith luminance values are important in terms of light source efficacy and when integrated with electric lightning in commercial building that could reduce energy and power consumption (Junsiri et al.2012).From the graph of zenith luminance, the polynomial equation was produced by using a curve fitting toolbox from origin where $L_z = 0.02\ \alpha^2 - 0.038\alpha + 1.005$ and the coefficient of determination (R^2) is 0.969. This is the best fit because the value is almost near to 1. The result of this research is useful for studies on solar energy, particularly on daylight availability. The knowledge obtained should be utilized in a useful manner for the country of Malaysia towards energy in sustainable development.

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