Solar Radiation Resources Under Climate Change Scenarios - A Case Study in Kota Kinabalu, Sabah, Malaysia

ABSTRACT

Solar power is the third major renewable energy after hydropower and biopower. It constitutes an increasingly important element of the global future that is less carbon energy investment. However, the generation capacity, availability, and intermittency of this renewable energy source is strongly climate dependent. Therefore it makes this renewable energy supply system more vulnerable to climate variability and changes. When considering solar energy as a sustainable energy solution, it is important to not only quantify the present solar resource but to also anticipate how the solar resource as the indicator in electricity production potential will change under future climate change scenarios. In this study, we evaluate the climate change impact on solar photovoltaic (PV) power potential in Kota Kinabalu, a rapidly developing city in Malaysia, using the Weather Research Forecast Model (WRF) climate projections under RCP4.5 and RCP8.5 together with a PV Power Production Model (1MW). The projected median solar radiations were 193.6 Wm-2 and 211.9 Wm-2 in 2100 under RCP4.5 and RCP8.5 respectively. The changes in solar radiation were statiscally significant at 95% percentile for both climate scenarios. In comparison with the present day scenarios (181.8 Wm-2), the projected future mean solar radiations were also increased to 202.8 Wm-2 (RCP4.5) and 210.9 Wm-2 (RCP8.5), an increase of about 12% and 16% respectively. Results also indicated that the calculated annual average solar radiation for Kota Kinabalu at present-day and future scenarios were 1589.7 kWh/h2 (2014), 1773.4 kWh/h2 (2100-RCP4.5), and 1844.2 kWh/h2 (2100-RCP8.5), which are equivalent to 54.4 MW (2014), 60.7 MW (2100-RCP4.5), and 63.1 MW (2100- RCP8.5). Increases in energy production under future climate change scenarios show a promising trend and indicates a positive potential for solar energy to be harnessed in the Kota Kinabalu city area.