Appraising the viability of wind energy conversion system in the Peninsular Malaysia

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Abstract

To harvest the wind energy resource for power production, it is crucially important to carry out a preliminary study to understand the site-specific nature of wind at the intended site. Such knowledge is required to estimate the performance of a wind energy project in the area. This study investigates the wind energy potential for production of electric power in the Peninsular Malaysia. Wind speed data of six selected sites across the country collected over a period of 10–20 years are employed for the study. A statistical analysis of the wind speeds is carried out using the Weibull distribution model. Six identified commercially available wind turbines with rated capacity ranging from 20 kW to 1500 kW, with different speed parameters are simulated at the selected locations. Of the six sites evaluated in this paper, it is revealed that Mersing, having the highest monthly average wind speed and consequently the most viable, produces an average power density of 57.58 W/m2 with a capacity factor of only 4.39%. This is equivalent to 378 MW h energy production per annum at a levelised cost of 22 cents per kW h. This study also shows that the standard deviation of the average monthly wind speeds is a better factor than the average annual wind speed for ranking of selected sites in terms of annual energy production. Overall, the results obtained from this investigation show that large-scale wind energy is not viable in Malaysia due to weak wind regimes; however, small-scale wind energy system may be economically viable in a few regions most especially when the recently launched feed-in tariff in the country is extended to wind energy.

Keywords: Mean wind speed; Wind turbine; Weibull distribution function; Wind power density; Capacity factor; Wind turbine availability