

**Title :** Projected Seasonal Changes in Wind Speed and Wind Energy Potential in Northeastern Thailand under Future Climate Conditions (2079–2099)

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## ABSTRACT

This study investigates wind speed characteristics and wind energy potential at 100 m above ground level over Northeastern Thailand (14.5°N–18.0°N, 102.0°E–104.9°E) by comparing a baseline climate period (1980–1999) with future projections (2079–2099). Seasonal analyses employing spatial wind speed distribution, wind power density estimation, Weibull distribution modeling, and inferential statistical tests (independent samples t-test and Kolmogorov–Smirnov test) were conducted for summer and winter monsoon periods. Results reveal distinct seasonal variations in projected wind regime changes. During summer, the prevailing southwesterly monsoon persists; however, regional mean wind speed exhibits a modest decline from 6.17 m/s to 5.83 m/s despite localized increases. Weibull parameters indicate predominantly moderate conditions with minimal structural alterations, though differences between periods are statistically significant ( $p < 0.01$ ). In contrast, winter demonstrates substantially stronger conditions under northeasterly monsoon influence, with mean wind speed increasing from 8.19 m/s to 9.19 m/s. Elevated Weibull shape and scale parameters suggest enhanced wind intensity and temporal stability. These findings indicate that climate change will impose seasonally differentiated impacts on regional wind regimes: slight summer attenuation contrasted by marked winter enhancement. The pronounced improvement in winter wind energy potential underscores the viability of Northeastern Thailand for future wind energy development, particularly for projects optimized to capitalize on winter monsoon conditions.

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