

**DETERMINATION OF THE WIND POWER PARAMETERS FOR THE ASSESSMENT  
OF THE WIND ENERGY POTENTIAL FOR SOME  
SELECTED SITES IN KENYA**

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## ABSTRACT

An investigation of the wind energy potential for some selected sites in Kenya was done to determine the wind power parameters namely, 'Weibull', 'Wind class' and 'Return period'. Diurnal, monthly and inter-annual variability of the wind speed and direction was investigated using empirical methods including the Power law, Logarithmic law and Weibull statistics. The Weibull shape parameter  $k$  (dimensionless) and the scale parameter  $c$  (m/s) were determined and the wind shear profile analyzed for 50 m height. Wind Rose plots were done to determine the frequency with which wind stayed in a particular direction sector. Finally, the extreme wind speeds were modeled to determine the return period.

Marsabit, Lamu, Garissa, Mombasa and Kisumu sites were found to have registered wind speeds greater than 3 m/s at the 50 m height for the period of the study. Nyeri and Kericho registered the lowest annual wind speed averages.

Results from the Probability Distribution Functions (PDF) revealed that Marsabit with a  $k > 2$  had available power densities greater than  $1800 \text{ W/m}^2$  for the period under investigation. All the other stations had values of  $k < 2$  and power densities below  $250 \text{ W/m}^2$ . Marsabit was found to be in the wind class range of 7 and above for all the years considered. 10 out of the 12 years considered for Lamu had wind power densities greater than  $100 \text{ W/m}^2$ , while only 2 years of the 6 considered for Mombasa had power densities greater than  $100 \text{ W/m}^2$ . Kisumu registered wind power densities greater than  $100 \text{ W/m}^2$  in 5 of the 12 years considered while Garissa had over  $100 \text{ W/m}^2$  in 4 out of the 6 years considered. All the other stations registered wind power densities below  $100 \text{ W/m}^2$ .

The results from extreme winds obtained from the best Gumbel fits revealed that Mombasa (49.5 m/s), Kisumu (40.3 m/s), Marsabit (31.6 m/s) had high wind speeds for the 20 years return period. Such extreme wind speeds require great attention when making decisions about the type and size of wind turbines to be installed. All the other stations, Lamu (29 m/s), Garissa (25.8 m/s), Eastleigh (17.6 m/s), Kericho (16.8 m/s) and Nyeri (12.2 m/s) had extreme wind speeds below 30 m/s.