Journal

International Journal of Ambient Energy

Latest Articles

Original Articles

Economics of wind energy utilisation for water pumping and CO_2 mitigation potential in Niger Delta, Nigeria

Fidelis I. Abam & Olayinka S. Ohunakin

Pages 1-11 | Received 28 Jul 2014, Accepted 20 Aug 2015, Accepted author version posted online: 24 Aug 2015, Published online: 19 Oct 2015

Abstract

The wind characteristics of six locations in Niger Delta, Nigeria, and the economics of the application of wind energy for water pumping and possible avoidable CO_2 emissions through wind utilisation were examined. The wind data were measured at 10 m height and analysed using the two-parameter Weibull model. Small size wind turbines were accessed with Goulds 45J03 water pump series. The average power density, average energy density and annual energy across locations ranged between

$6.28 \leq \text{APD} \leq 102.90$ W/m^2,

$4.49 \leq AED \leq 82.96$ kWh/m^2 and $422 \leq AE \leq 747$ kWh/m^2/year, respectively. Bergey Excel-10 kW turbine had the lowest cost of energy and water pumping cost of $0.022 \leq COE \leq 0.151$ $/kWh and $0.074 \leq WPC \leq 0.403$ $/m^3, respectively. The annual capacity of water yield varies from 21,847 to 120,206 m^3/year on a total dynamic head of 50 m. Furthermore, the annual diesel saved across the locations ranged from 1605 to 8696 l/year (17.47 to 94.67 GJ/year), while the annual averaged CO_2 saved was between 4.32 and 22.93 tons/year.

KEYWORDS: Wind energy, CO_2 emissions, water pumping, wind turbine