World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:17, No:06, 2023

Effect of Geometry on the Aerodynamic Performance of Darrieus H Ype Vertical Axis Wind Turbine

Authors : Belkheir Noura, Rabah Kerfah, Boumehani Abdellah

Abstract : The influence of solidity variations on the aerodynamic performance of H type vertical axis wind turbine is studied in this paper. The wind turbine model used in this paper is the three-blade wind turbine with the symmetrical airfoil, NACA0021. The length of the chord is 0.265m. Numerical investigations were implemented for the different solidity by changing the radius and blade number. A two-dimensional model of the wind turbine is employed. The approach a Reynolds-Averaged Navier–Stokes equations, completed by the K- ώ SST turbulence model, is used. Motion mesh model capability of a computational fluid dynamics (CFD) solver is used. For each value of the solidity, the aerodynamics performances and the characteristics of the flow field are studied at several values of the tip speed ratio, λ = 0.5 to λ = 3, with an incoming wind speed of 8 m/s. The results show that increasing the number of blades will reduce the maximum value of the power coefficient of the wind turbine. Also, for the VAWT with a lower solidity can obtain the maximum Cp at a high tip speed ratio. The effects of changing the radius and blade number on aerodynamic performance are almost the same. Finally, for the validation, experimental data from the literature and computational results were compared. In conclusion, to study the influence of the solidity in the performances of the wind turbine is to provide the reference for the design of H type vertical axis wind turbines.

Keywords : wind energy, darrieus h type vertical axis wind turbine, computational fluid dynamic, solidity
Conference Title : ICIRESET 2023 : International Conference on Integrated Renewable Energy System Engineering and Technology
Conference Location : Istanbul, Türkiye
Conference Dates : June 22-23, 2023