عنوان مقاله:

Unsteady aerodynamic performance of Dual-Row H-Darrieus vertical axis wind turbine

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خلاصه مقاله:

H-rotor Vertical Axis Wind Turbine (VAWT) is one of the most efficient energy suppliers which have been investigated in many recent types of research. The aim of this work is to study the aerodynamic performance of a doubled-row H-Darrieus VAWT. First, an ordinary three-bladed VAWT with NACA4415 profile is simulated by means of 3D computational fluid dynamics (CFD) and results are compared to a recently published research work based on Blade Element Momentum (BEM) theory. Afterward, a doubled-row H-Darrieus VAWT is simulated and analyzed in two different geometric configurations. In the first configuration, a second row with the same blade characteristics of the first row is added aligned with the first row and with 0.2 m distance toward it. In the second one, again with the same blade characteristics, the secondary blade is added with 0.2 m distance toward first row, but with 60 degrees angular offset. Renormalization-Group (RNG) k-ε turbulence model besides wall function is applied in all unsteady simulations. As comparative tools, based on other studies using the same coefficients, momentum coefficient ( ) and power coefficient   are calculated in all simulations to investigate which case operates more efficiently. It is observed that adding a second row to an ordinary H-Darrieus VAWT will improve these coefficients up to 314% which is a considerable leap in power production ability of the VAWT. Also, different turbulence models, geometries (with a central shaft and without central shaft) and solution methods were also analyzed and the effect of each one was computed and compared with other cases.

کلمات کلیدی:

H-Darrieus, Doubled-Row VAWT, BEM, CFD, Performance

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