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The Effect of Velocity Increment by Blockage Factor on Savonius Hydrokinetic Turbine Performance

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Abstract : Hydrokinetic turbines can be used to produce power in inaccessible villages located near rivers. The hydrokinetic turbine uses the kinetic energy of the water and maybe put it directly into the natural flow of water without dams. For off-grid power production, the Savonius-type vertical axis turbine is the easiest to design and manufacture. This proposal uses three-dimensional computational fluid dynamics (CFD) simulations to measure the considerable interaction and complexity of turbine blades. Savonius hydrokinetic turbine (SHKT) performance is affected by a blockage in the river, canals, and waterways. Putting a large object in a water channel causes water obstruction and raises local free stream velocity. The blockage correction factor or velocity increment measures the impact of velocity on the performance. SHKT performance is evaluated by comparing power coefficient (Cp) with tip-speed ratio (TSR) at various blockage ratios. The maximum Cp was obtained at a TSR of 1.1 with a blockage ratio of 45%, whereas TSR of 0.8 yielded the highest Cp without blockage. The greatest Cp of 0.29 was obtained with a 45% blockage ratio compared to a Cp max of 0.18 without a blockage.

Keywords : savonius hydrokinetic turbine, blockage ratio, vertical axis turbine, power coefficient
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