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## Performance Evaluation of Small Wind Turbine Using CFD

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**Abstract:**The main objective of this project is to operate a 3 KW small horizontal axis wind turbine at low wind site and to develop a tool to test the rotor blade and its characteristics without a help of the wind tunnel experiment. This may reduce the wind tunnel experiment analysis, cost as well as transportation cost. Power Coefficient is an important parameter for wind turbines. Coefficient of Power is examined based on Elementary blade element and momentum theory<sup>1</sup>. Development of small wind turbine generators which are sufficiently safe and easy to run on individual homes and for self-sufficient and independent power production<sup>1</sup>. The coefficient of lift and drag is analyzed in CFD for different wind speed and constant angle of attack 5. Blade profile is based on NACA 4418 airfoil. As per Betz theory, a 3 KW capacity of wind turbine requires 2.3m length of the blade. Blade length is divided into no of division; in each division chord length will be different. Geometry of airfoil is created using Gambit2.3.16 and CFD analysis is carried out in FLUENT 6.3.26, While analyzing the airfoil with different chord length in GAMBIT-FLUENT, will give the performance characteristics of blade for different wind speed. Calculation for Coefficient of Power is done by iterating method<sup>2</sup>. Results are obtained and graphically represented. This approach is very helpful to find Coefficient of Power at different chord position for different blade.

**Keywords:**CFD, Gambit Fluent,  $C_p$ ,  $C_L$ ,  $C_D$ , BEM.