Abstract

Wind energy is a critical component of the global shift toward renewable energy, with wind turbine blades playing a pivotal role in determining aerodynamic efficiency and energy output. This study explores optimization strategies for blade geometry, focusing on chord length distribution, twist angle, and air foil shape, to enhance performance while reducing material costs. Computational techniques, including Computational Fluid Dynamics (CFD) and genetic algorithms, are employed to analyse and optimize blade designs. The results demonstrate significant improvements in turbine efficiency and cost-effectiveness, with potential applications in the sustainable energy industry. This literature review adds to the propagating of wind turbine technology by integrating these optimization methods to pave the way for a more economically viable energy alternative.

Keywords- Wind turbine Optimization, Blade Design, Aerodynamic efficiency, Computational Techniques, Sustainability.