Hybrid solar wind generator design

Aside from self-starting ability, efficiency and optimization of the wind turbine were discussed in the studies, with CFD analysis used in the majority of cases. An unsteady (transient) ‘‘Reynolds-Averaged-Navier-Stokes’’ (URANS) method was used as well as a quadratic equation based on a regression model and a rotational degree of freedom solver (6DOF). Obtaining an accurate prediction of the turbine"s behavior during startup requires the correct distribution of the lift and drag forces [14,15].

For the purpose of juxtaposing studies in the existing literature, Table 1 serves as an illustrative benchmark, delineating key facets for comparison. These facets encompass:

F1–Working Mechanism of Darrieus Wind Turbine and/or Solar System: This factor delves into the operational intricacies of the Darrieus wind turbine and solar energy system, dissecting their functional synergies.

F2–Optimization Technology for Darrieus Rotor Blades: Within this parameter, the technological approaches employed for optimizing the performance of Darrieus rotor blades are examined.

F4–Development of Proposed Design: This factor scrutinizes the evolution and formulation of the proposed design within the context of the studied systems.

F5–Efficiency Enhancement of the System: The enhancement of system efficiency is a central consideration within this component, encompassing strategies and methodologies applied to bolster overall performance.

By dissecting these facets and presenting their nuances within Table 1, a comprehensive comparison across various studies is facilitated, contributing to a more holistic comprehension of the research landscape.

The research method is initiated with the design of the Darrieus wind turbine rotor airfoil as the airfoil affects the self-starting capability of the rotor and its ability to generate power. In this phase, there are several parameters that must be considered such as the TSR, geometry of the rotor, drag and lift coefficient, solidity, and forces of drag and lift.

The Geometry of the Rotor refers to the physical dimensions and characteristics of the wind turbine rotor, including the length and shape of the blades. A rotor with longer blades will capture more wind energy, while the shape of the blades influences aerodynamic performance.

The Drag Coefficient represents the drag force experienced by an object moving through a fluid, in this case, the wind. A low drag coefficient indicates that the rotor blades encounter less resistance, improving overall efficiency.

The Lift Coefficient measures the lift force generated by the wind turbine blades due to aerodynamic lift. A higher lift coefficient signifies increased lift force, contributing to the efficient rotation of the wind turbine.

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