

عنوان مقاله:

(Aerodynamic design and economical evaluation of site specific horizontal axis wind turbine (HAWT)

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خلاصه مقاله:

This paper presents the aerodynamic design and economical evaluation of a 200 kW site specific wind turbine for the province of Semnan in Iran. By designing site specific wind turbines, the cost of energy which is calculated out of the annual energy production and also the cost of manufacturing the rotor are minimized. The aerodynamic design is based on the well-known blade element momentum theory (BEM) which is integrated with annual wind distribution of the designated wind site to determine the net annual electricity yield for two designed rotors. In the first rotor, a linear fit approximation is used for the chord length and twist angle distributions for ease of manufacturing and to overcome technological barriers in Iran. In the second rotor, the optimum original nonlinear distribution of the blade is assumed. The RISØ-A-24 aerofoil is used and optimized for the design tip speed ratio of $\lambda=8.93$ for both rotors. Pitch angle control is also adopted here. A comparison is made between the aerodynamic performance and decrease of manufacturing costs for both rotors. The economic feasibility indicates that based on current electricity costs of 12 cent per kWh in Iran for renewable energies, a profit of 7.2 cent and 8.1 cent per each kWh generated power is achievable respectively by the linear and nonlinear rotor designs. Therefore, the scenario of reducing initial costs is not recommended unless technological shortcoming in manufacturing rotor cannot be avoided.

کلمات کلیدی:

Aerodynamic performance, BEM theory, Economical evaluation, Horizontal axis wind turbine (HAWT), Site specific

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