

Exergy Analyses of Wind Turbine

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Abstract : Utilization of renewable energy resources for energy conservation, pollution prevention, resource efficiency and systems integration is very important for sustainable development. In this study, we perform energy and exergy analyses of a wind turbine, located on the roof of Mechanical Engineering Department, King Saud University, and Riyadh, Saudi Arabia. The turbine is part of a hybrid photovoltaic (PV)-wind system with hydrogen storage. The power output from this turbine varies between 1.5 and 5.5 kW with a rated wind speed of 12 m/s and a cut-in wind speed of 2.4 m/s. We utilize a wide range of experimental data in the analysis and assessment. We determine energy and exergy efficiencies. The energy efficiency changes between 0% to 45% while the exergy efficiency varies between 0% and 31.3%. We also determined some of the exergoeconomic parameters that are the ratios of energy and exergy loss rates to the capital cost (R_{en} and R_{ex}), respectively. (R_{en}) changes between 0.96% and 59.03% for different values of velocity while R_{ex} has a maximum value of 53.62% for the highest wind speed.

Keywords : exergy, efficiency, performance evaluation, wind energy

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