

Abstract

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Comparative analysis of different wave turbine designs based on conditions relevant to northern coast of Egypt

Wave energy has a great potential to solve the unrelenting energy deficiency in Egypt. The present work recommends Wells turbine as a suitable choice for the Egyptian coasts due to its simple and efficient operation under low input air flow. In addition, the possibility of extracting the wave energy from the Egyptian coasts was investigated using the oscillating water system based on real data from the site. To achieve this purpose, two-dimensional numerical models for Wells turbine airfoils, functioning under sinusoidal wave flow conditions, were built. Moreover, the running and starting characteristics under sinusoidal-flow conditions were investigated using a mathematical code. The results were discussed using the first law analysis, in addition to the second law analysis by using the entropy generation minimization method. It was found that the NACA0015 airfoil always gives a global entropy generation rate that is less than other airfoils by approximately 14%, 10.3% and 14.7% for the sinusoidal wave with time periods equal to 4, 6 and 8 s respectively. Moreover, the effects of blade profile, time period and solidity on the output power (kW) value were discussed.