Abstract

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Novel approach of bidirectional diffuser-augmented channels system for enhancing hydrokinetic power generation in channels

Hydrokinetic is a recently introduced type of hy ower energy, having been proven as the most effective and predictable renewable energy source available around the world, especially in the rural and electrification areas. Most of these sites are dependent on small and micro scale stations to produce cheap but abundantly available and effective electrical energy. Hydrokinetic energy that can be harnessed from the flow of water in the irrigation and rainy channels is a promising technology in countries with vast current energy. Micro hydrokinetic energy scheme presents an attractive, environmentally friendly and efficient electric generation in rural, remote and hilly areas, as effort to reduce the everincreasing greenhouse gas emissions and fuel prices in these sites. Though potential, this scheme is yet to be fully discovered to the considerable extent, as researchers are still searching for solution for the main problem of low velocity of current in the open flow channels. Deploying acceleration nozzle in the channel is a unique solution for increasing the channels current flow systems' efficiency. Acceleration nozzle channel method has numerous advantages especially on the environmental impact, yet has not been given much attention in the renewable energy field. This paper proposes a novel system configuration to capture as much as kinetic energy from in stream current water. This system, known as bidirectional diffuser-augmented channel functions by utilizing dual directed nozzles in the flow, surrounded by dual cross flow turbines. This type of turbine is commonly used for hy ower applications and this study proposes the employment of this turbine for hydrokinetic power generation. Numerical investigations had been performed using finite volume Reynolds-Averaged NaviereStokes Equations (RANSE) code Ansys CFX to investigate the flow field characteristics of the new system approach with and without the turbines. The performance of the twin (lower and upper) cross flow turbines had also been studied. It was found that the highest efficiency of 0.52 was recorded for lower turbine at tip speed ratio (TSR) of 0.5.