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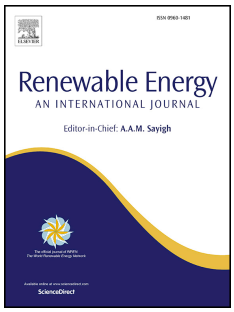

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D. Powell, A. Ebrahimi, S. Nourbakshsh, M. Meshkahaldini, A.M. Bilton

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Design of Pico-Hydro Turbine Generator Systems for Self-Powered Electrochemical Water Disinfection Devices

D. Powell[1], A. Ebrahimi[1], S. Nourbakshsh[2], M. Meshkahaldini[2], and A. M. Bilton[1]*

[1] Water and Energy Research Laboratory (WERL)
Department of Mechanical and Industrial Engineering,
Faculty of Applied Science and Engineering,
University of Toronto, Toronto, Ontario, Canada

[2] Formarum Inc.
Richmond Hill, Ontario, Canada

***Corresponding author:**
A. M. Bilton
Mechanical & Industrial Engineering, Faculty of Applied Science & Engineering
University of Toronto
5 King's College Road Toronto, ON M5S 3G8
Tel: (416) 946-0622 Fax: (416) 978-7753 Email: bilton@mie.utoronto.ca

Abstract

Previous research has demonstrated the potential of pico-hydro turbines to provide reliable electricity in applications such as rural electrification. However, the literature has primarily focused on the development of turbine systems for design environments where spatial and flow rate constraints tend to be non-restrictive. The work detailed in this paper presents the development of a novel, compact, high efficiency turbine capable of powering a compact electrochemical cell for off-grid water disinfection. The turbine with the generator is capable of generating nearly 100W of power with a footprint of only 8" in length and 4" in diameter. A basic mathematical model of a DC generator is coupled to a computational fluid dynamics (CFD) turbine model to evaluate different system configurations. Following a Taguchi Method study to computationally explore the turbine design space, experimental testing of improved turbine configurations is shown to provide electrical power output improvements of 20%. Selection of a more compatible DC generator also provides electrical power output and efficiency improvements of a factor of 2 and 2.5 respectively.