Accepted Manuscript

Design of pico-hydro turbine generator systems for self-powered electrochemical water disinfection devices

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

PII: S0960-1481(17)31285-5

DOI: 10.1016/j.renene.2017.12.079

Reference: RENE 9576

To appear in: Renewable Energy

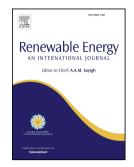
Received Date: 19 June 2017

Revised Date: 12 December 2017

Accepted Date: 24 December 2017

Please cite this article as: Powell D, Ebrahimi A, Nourbakshsh S, Meshkahaldini M, Bilton AM, Design of pico-hydro turbine generator systems for self-powered electrochemical water disinfection devices, *Renewable Energy* (2018), doi: 10.1016/j.renene.2017.12.079.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



1	Design of Pico-Hydro Turbine Generator Systems for Self-Powered
2	Electrochemical Water Disinfection Devices
3 4	D. Powell ¹ , A. Ebrahimi ¹ , S. Nourbakshsh ² , M. Meshkahaldini ² , and A. M. Bilton ¹ *
5	¹ Water and Energy Research Laboratory (WERL)
6	Department of Mechanical and Industrial Engineering,
7	Faculty of Applied Science and Engineering,
8 9	University of Toronto, Toronto, Ontario, Canada
9 10	² Formarum Inc.
11	Richmond Hill, Ontario, Canada
12	
13	*Corresponding author:
14 15	A. M. Bilton Mechanical & Industrial Engineering, Faculty of Applied Science & Engineering
16	University of Toronto
17	5 King's College Road Toronto, ON M5S 3G8
18	Tel: (416) 946-0622 Fax: (416) 978-7753 Email: bilton@mie.utoronto.ca
19	Abstract
20	Previous research has demonstrated the potential of pico-hydro turbines to provide reliable
21	electricity in applications such as rural electrification. However, the literature has primarily focused on
22	the development of turbine systems for design environments where spatial and flow rate constraints
23	tend to be non-restrictive. The work detailed in this paper presents the development of a novel,
24	compact, high efficiency turbine capable of powering a compact electrochemical cell for off-grid water
25	disinfection. The turbine with the generator is capable of generating nearly 100W of power with a
26	footprint of only 8" in length and 4" in diameter. A basic mathematical model of a DC generator is
27	coupled to a computational fluid dynamics (CFD) turbine model to evaluate different system
28	configurations. Following a Taguchi Method study to computationally explore the turbine design
29	space, experimental testing of improved turbine configurations is shown to provide electrical power
30	output improvements of 20%. Selection of a more compatible DC generator also provides electrical
31	power output and efficiency improvements of a factor of 2 and 2.5 respectively.

Download English Version:

https://daneshyari.com/en/article/6764596

Download Persian Version:

https://daneshyari.com/article/6764596

Daneshyari.com