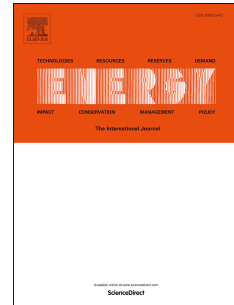


# Accepted Manuscript

Analytical and numerical investigation of unsteady wind for enhanced energy capture in a fluctuating free-stream

David Wafula Wekesa, Cong Wang, Yingjie Wei, Louis Angelo M. Danao



PII: S0360-5442(17)30041-5

DOI: [10.1016/j.energy.2017.01.041](https://doi.org/10.1016/j.energy.2017.01.041)

Reference: EGY 10176

To appear in: *Energy*

Received Date: 29 July 2016

Revised Date: 23 November 2016

Accepted Date: 7 January 2017

Please cite this article as: Wekesa DW, Wang C, Wei Y, Danao LAM, Analytical and numerical investigation of unsteady wind for enhanced energy capture in a fluctuating free-stream, *Energy* (2017), doi: 10.1016/j.energy.2017.01.041.

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.

# Analytical and numerical investigation of unsteady wind for enhanced energy capture in a fluctuating free-stream

David Wafula Wekesa<sup>a,\*</sup>, Cong Wang<sup>b</sup>, Yingjie Wei<sup>b</sup>, Louis Angelo M. Danao<sup>c</sup>

<sup>a</sup>*Department of Physics, Machakos University, Machakos County, Machakos, Kenya*

<sup>b</sup>*Department of Aerospace Engineering and Mechanics, School of Astronautics, Harbin Institute of Technology, Harbin City, PR China*

<sup>c</sup>*Department of Mechanical Engineering, University of the Philippines, Diliman, Quenzon City, Philippines*

---

## Abstract

Unsteady wind is characterized by low energy content and large fluctuations. A Computational Fluid Dynamics (CFD)-based method for capturing wind energy in a fluctuating free-stream, supported by analytical formulations, is investigated in this paper. We implemented unsteady Reynolds-Averaged Navier-Stokes (RANS) solver to control the dynamic mesh motion. Using an urban wind resource, characteristic fluctuation frequencies at 0.5 Hz, 1.0 Hz, and 2.0 Hz have been selected to demonstrate the enhanced wind energy capture. The numerical energy coefficient marginally changed from 0.36 at 0.5 Hz to 0.37 at both 1 Hz and 2 Hz cases. The results reveal that the highest frequency of fluctuation with meaningful energy content in unsteady wind condition is  $\approx 1$  Hz. The study findings promote our understanding about the energy associated with short-period fluctuations reflecting realistic unsteady wind environment. Additionally, the present study approach to analyze wind energy capture on a H-Darrieus wind rotor in a fluctuating free-

---

\*Corresponding Author: *E-mail address: dwekesahit@gmail.com(D.W. Wekesa).*

Download English Version:

<https://daneshyari.com/en/article/5476365>

Download Persian Version:

<https://daneshyari.com/article/5476365>

[Daneshyari.com](https://daneshyari.com)