

Accepted Manuscript

Performance analysis of a small wind turbine equipped with flexible blades

David W. MacPhee, Asfaw Beyene

PII: S0960-1481(18)30964-9

DOI: [10.1016/j.renene.2018.08.014](https://doi.org/10.1016/j.renene.2018.08.014)

Reference: RENE 10441

To appear in: *Renewable Energy*

Received Date: 26 June 2017

Revised Date: 2 August 2018

Accepted Date: 4 August 2018

Please cite this article as: MacPhee DW, Beyene A, Performance analysis of a small wind turbine equipped with flexible blades, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.08.014.

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.



Performance Analysis of a Small Wind Turbine Equipped with Flexible Blades

David W. MacPhee^{a,*}, Asfaw Beyene^b

^a*Department of Mechanical Engineering, The University of Alabama,
Tuscaloosa, AL 35487, USA*

^b*Department of Mechanical Engineering, San Diego State University,
San Diego, CA 92182, USA*

Abstract

Wind turbine efficiency can drop drastically away from design conditions, which is especially troublesome for small fixed-pitch, constant speed types of devices and those operating in highly variable winds. Recent advances in the design of adaptive structures gives rise to a new turbine concept, employing continuous shape morphing, allowing the turbine to adapt more effectively to variable conditions. Such morphing blades could increase energy capture, and help small wind turbines become more economically viable through increased efficiency over a wide range of wind speeds and tip-speed ratios. In this paper, we examine the practicality of a flexible or *morphing* bladed turbine through experimental and numerical analysis. Experiments are conducted comparing a prototype rigid bladed design to an identical flexible one, with a total of 18 data sets containing 230 data points. Experimental results show that the flexible design outperforms the rigid one, especially when experiencing unfavorable loading conditions. Maximal corrected power coefficients were increased in all cases, up to 32.6%. The operational range was also increased in most cases, to a maximum of 34.5% over the rigid bladed design. These results suggest that the flexible design could produce more power than a rigid one, especially when conditions are sub-optimal.

Keywords: wind, turbine, flexible, energy, morphing, FSI

*Corresponding author

Download English Version:

<https://daneshyari.com/en/article/6763587>

Download Persian Version:

<https://daneshyari.com/article/6763587>

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