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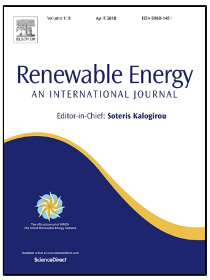

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PII:	S0960-1481(18)30143-5
DOI:	10.1016/j.renene.2018.02.007
Reference:	RENE 9738
To appear in:	*Renewable Energy*
Received Date:	15 September 2015
Revised Date:	30 January 2018
Accepted Date:	01 February 2018

Please cite this article as: Reza Hassanzadeh, Omar Yaakob, Ahmadali Gholami, Maryam Pourmahdavi, Mehdi Hosseinzadeh, Mohammad Mahdi Taheri, Yasser M. Ahmed, Experimental Investigation of an Innovative Configuration for New Marine Current Turbine, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.02.007

Experimental Investigation of an Innovative Configuration for New Marine Current Turbine

Reza Hassanzadeh*[a], Omar Yaakob[b], Ahmadali Gholami[c], Maryam Pourmahdavi[d]
Mehdi Hosseinzadeh[a,e], Mohammad Mahdi Taheri[a,f], Yasser M. Ahmed[b,g]

[a] *Iran University of Medical Science, Tehran, Iran*
[b] *Faculty of Mechanical Engineering, UniversitiTeknologi Malaysia, 81310, Skudai, Johor, Malaysia*
[c] *Faradidgostar Energy Company, Entrepreneurship center & Relationship between University of Mazandaran (UMZ), Iran*
[d] *School of mechanical engineering, Iran University of Science & Technology, Teharn, Iran*
[e] *University of Human Development, Sulaimaniyeh, Iraq*
[f] *Department of Bioengineering, University of Illinois at Chicago, Chicago, USA*
[g] *Faculty of Engineering, Alexandria University, Egypt*

* Corresponding author. Tel.: +982144074802; +989909404047. Email address: rhm1425@gmail.com;

Abstract. The numerous benefits of Savonius turbine including simplicity in structure, appropriateness of its self-start ability, operating in relatively low velocity, independency from flow direction and its low environmental burdening have caused the Savonious to gain momentum in recent Marine Current Turbine research. However, the turbine suffers from low efficiency as compared with other water turbines. This paper proposes a novel Savonius turbine configuration design for marine currents. The new model design was tested in the Universiti Teknologi Malaysia (UTM) in the low-speed wind tunnel at different speeds while measuring parameters such as pressure and performance. The experiment was conducted by measuring the pressure distribution on blade surfaces. Various angles of the new rotor were tested at different speeds in the low-speed wind tunnel. The comparison revealed substantial improvement in turbine efficiency for the new configuration in comparison with the conventional design.

Keywords: Marine current turbine, Pressure distribution, Novel turbine, Different Speeds

1. Introduction

Currently, generation of electricity from renewable energy has gained momentum in research, which is due to its advantages in certain areas such as developing public health, creating less CO2 and bearing lower cost compared to those of fossil fuels [1, 2]. Ocean energy is a huge source of renewable energy. As oceans encompass 70% of the planet Earth, ocean currents can be considered as the main suitable energy sources on our planet.

Generally, there are two main types of current turbines; the horizontal axis marine current turbine (HAMCT), [3, 4] and the vertical axis marine current turbine (VAMCT) [5, 6]. one of the applications of VAMCT is the Savonius turbine [7] which is utilized for wind energy applications where there are low-speed current flows. However, the conventional Savonius turbine has low efficiency and negative torque, especially at angle values of 135° to 165° and 315° to 345° [8]. Therefore, certain improvement methods such as enhancing the blade stages to two or three steps have been proposed to increase efficiency of Savonius turbine [9, 10]. According to results reported by Yaakob et al. [11, 12], in spite of the existence of relatively shallow waters and ocean currents with low velocity in Malaysia (around 0.56 m/s), it can be a suitable context for the newly proposed turbine to be experimented.

The simulation has been used in a large group of scientific works to determine the performance and reliability of systems before designing and actual construction. Due to the cost-effectiveness,