

Summary of Master Thesis

PERFORMANCE STUDY OF THE SAVONIUS WIND TURBINE

Supervised By

**Prof. Nabile Hanafy
Mahmoud**

Professor, Mechanical Power Eng. Dept.
Faculty of Engineering, Shebin El-Kom,
Minoufiya University

**Assoc. Prof. Ahmed Ashour
El-Haroun**

Assoc. Professor, Mechanical Power Eng.
Dept. Faculty of Engineering, Shebin El-
Kom, Minoufiya University

Dr. Esam Mohamed Ahmed Wahba

Lecturer, Mechanical Power Eng. Dept. Faculty of Engineering, Shebin El-Kom, Minoufiya
University

Abstract of the Master Thesis

For solving the energy problem and the bad effect of conventional sources of energy on environment, great attention in many countries is paid towards the use of renewable energy sources. Special interest is paid towards wind energy because of it's competitiveness.

Savonius rotor is a vertical axis wind turbine which characterized as cheaper, simpler in construction and low speed turbine. This makes it suitable for generating mechanical power in many countries especially in Egypt.

In this work different geometrics of Savonius wind turbines are studied experimentally in order to determine the most effective operation parameters. A verification of results is done through the measurement of the static torque affected

on the stationary rotors. A prototype of Savonius rotor is designed according to the obtained experimental parameters. The designed prototype is fabricated and tested in free wind in El-Arish at the Faculty of Engineering, Sinai University.

It was found that, the two blades rotor is more efficient than three and four ones. The rotor with end plates gives higher efficiency than those without end plates. Double stage rotors have higher performance than single stage rotors. The rotors without overlap ratio (β) are better in operation than those with overlap. The results show also that the power coefficient increases with rising the aspect ratio (α). The conclusions from the measurements of the static torque for each rotor at different wind speeds verifying the above summarized results of this work.

The measurements of the prototype in Arish showed that, it works in free wind with a considerable efficiency. It begins to give power at a relative low wind speed of about 2 m/s. The output energy from Savonius rotor is relatively small due to smaller efficiency of Savonius rotor compared to higher efficiencies of horizontal axis wind turbines. On the other word, the cost of energy unit is also small and competitive with other energy sources due to the lower cost of construction.

The use of Savonius rotor will be attractive in many locations in Egypt. The cost of kW.hr generated from Savonius rotor is expected to be very low specially in locations with high average wind speed. The majority of the Egyptian locations having an average wind speed between 3.5 and 4.5 m/s. The cost of kW.hr generated from Savonius rotor in these locations is expected to be between 0.42 and 0.28 LE. In locations where average wind speed is 6 m/s, the cost of kW.hr is expected to be 0.1 LE.

Therefore the Savonius rotor can be used in the majority of the Egyptian locations, for example, to pump water for irrigation of land. This will save a great part of conventional energy sources used for this purpose and consequently reduce the environmental pollution.