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Variation in Rotational Speed of Three BLADED Savonius Rotor with Respect to Change in Chord Length of the Deflector Around it

Anju Bordoloi[1] and K.K. Sharma[2]

[1]M.Tech in Thermal Engineering NIT Silchar Mechanical Engineering Dept.
[2]NIT Silchar Mechanical Engineering Dept.
E-mail: [1]snz.bordoloi181@gmail.com, [2]kksharma1313@rediffmail.com

Abstract—*A earlier made three bladed Savonius rotor has been taken and its base is fixed on a square plate of cast iron . Around the Savonius rotor eight semi-circular(non-movable or deflector) blades had been kept and are fixed on the square plate at an equal interval of 45°. The model is kept in front of the circular pipe just after the blower and the speed of the air coming out from the circular pipe of the blower is varied by a valve inside the circular pipe , The diameter of the deflector is 74mm, and the maximum rotational speed obtained is nearly 570 RPM if we use 8 deflector having diameter of 74mm. But if we take 6 deflector having the diameter little more than the double of earlier one it is seen that that maximum rotational speed obtained is 710 RPM ,while the maximum rotational speed without defelector is 415 RPM. Thus , it can be concluded that by varying the length of the chord of the deflector it is seen that there is considerable change in the rotational speed of Savonius rotor. Hence this concept may be very much useful , if we use this type of wind-mill in practice .*

1. INTRODUCTION

The ‘savonius’ type of vertical axis wind rotor was developed initially by S.J.Savonius in 1929, but the concept never became popular because of its low efficiency. However it has the following advantages over the horizontal axis type of its family.

1. Simple construction.
2. Lack of necessity for over –speed control.
3. Acceptance of wind from any direction without orientation.
4. Inexpensive.

The above advantage can make it suitable turbine for small scale applicaton in rural and remote places,where electricity is scare.The idea of designing the vertical axis wind mill by Savonius used a rotor formed by cutting a Flettner cylinder from top to bottom and then moving the twylindrical surfaces sideways along the cutting plane so that the cross-section resembled the letter ‘S’.Savonius tested more than 30 different models of his ‘S’ rotor in a wind tunnel tests and reported encouraging results.After the the completion of wind tunnel tests,Savonius conducted further tests,in natural wind.He reported that the ‘S’ rotor ran at a higher speed in natural wind than the wind tunnel for the wind tunnel for the same wind speed.The best of his rotor models had an efficiency of 37%,whlile the maximum reported efficiency for the full scale prototype was 37%.Following Savonius ,Bach made some investigations of the Savonius rotor andrelated machines,with the best measured efficiency 24%.

Between 1960’s and 1990’s.Newman,Ushiyama and Nagai conducted several testson this kind of machine.The best measured efficiency in the model was 33%,reported by Mcpherson,while the maximum power coefficient by newman was 0.20.On the best of his model tests,Newman concluded that the full scale performance of the rotor cannot be estimated from the model test results because of wind tunnel interference,but model tests can be used to assess the relative merits of each rotor.Sharma et al conducted experiments on model of overlapped Savonius rotor in wind tunnel.The overlap was varied between 1.8cm to 1.5cm.Sharma et al got encouraging g results.they got efficiency 52%.Blackwell B.F. et al studied fifteen configurations of three-bucket S-rotor in a wind tunnel conditions.The best of his model rotors produced an efficiency of 18%.they also conducted that the three bucket S-rotor taking tunnel blockage into consideration.The savonius turbine is one of the simplest turbines.Aerodynamically,it is a drag- type device,consisting of two or three scoops.Looking down on the rotor from above,a two scoop machine would look like ‘S’ shape in cross section.because of the curvature, the scoops experience less drag when moving against the wind tha when moving with the wind.The differential drag causes the Savonius turbine to spin.Because they are drag type devices,Savonius turbines extract much less of the wind’s power than other similarly-sized lift type turbines.

2. FABRICATION OF EXPERIMENTAL SET-UP

An experimental set-up has been fabricated like this.A three-bladed Savonius rotor has been taken.It is fixed on a square plate of cast iron.Around the three bladed Savonius rotor eight semi-circular blades and then six semi-circular blade of different dimension has been fixed on the square plate(which works as the deflector blades) and tested one after the other.

The experimental set up comprises of blower section,convergent-divergent nozzle,straight section and gate at the end.The velocity is found out by the use of an anemometer and RPM with the help of a tachometer.

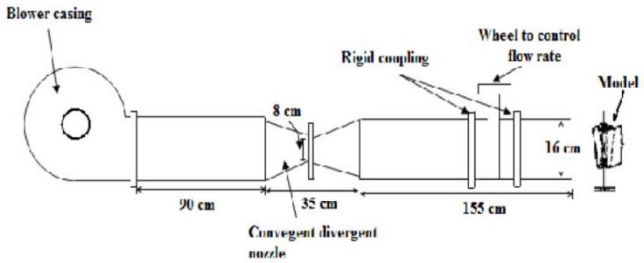

Fig. 1: Schematic Diagram of Blower

Fig. 2: Experimental set up of savonius rotor with six deflector blades

3. RESULTS

Following results are found out and has been tabulated as follows:

Table 1: RPM at Different Wind Velocities (Without Deflector Blades)

Sl. No	Wind Velocity(m/s)	RPM
1	11.2	320
2	14.4	356
3	16.2	383
4	17.5	397
5	19	415

Table 2: RPM at Different Wind Velocities with 8 deflector Blades of Height 15 cm and Chord Length 7cm.

Sl. No	Wind Velocity(m/s)	RPM
1	11.2	421
2	14.4	481
3	16.2	512
4	17.5	538
5	19	567

Table 3: RPM at Different Wind Velocities with 6 deflector Blades of Height 30 cm and Chord Length 15cm

Sl. No	Wind Velocity(m/s)	RPM
1	11.2	518
2	14.4	593
3	16.2	617
4	17.5	665
5	19	710

4. CONCLUSION

Thus it can be concluded from the above results that we can obtain better RPM results with the the use of deflector blades rather than not using one. It has also been observed that we can increase the output further when we use deflector blades of higher dimensions(increased height and chord length).

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