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TEST CHARACTERISTICS OF THE TURBINE SAVONIUS 4 LEVELS SECTIONAL, PARTITIONED, 0.25 DIAMETER OVERLAP AND 45^o SLIDING ANGLE WITH COMPARABLE STANDARD TURBINE

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ABSTRACT

The energy and environmental crisis where CO_2 causes global warming and climate change. This condition encourage the world community take advantage of new renewable energy non-CO2 as wind, water currents, geothermal, solar, etc. Savonius Turbine has a simple construction can be made by the public so they can be used for wind power or hydro countryside. In this study aims to improve the efficiency and reduce the amplitude of vibrations to the modification of the 4-storey Savonius turbine, partitioned, sliding angle 45 degree and 0.25 diameter blade overlap. The location of research is Cokro Tulung Channel Klaten and Parangrucuk Baron Beach Gunungkidul. Measurements such as water current and wind speed, turbine rotational speed, torque of the turbine shaft and power. The turbines analysis are torque, power and efficiency characteristics and comparing by the turbine Savonius standard (one pair of blades). Results as hydro turbine at low velocity 0.3166 m/s Savonius 4 level had better revolution and efficient (0.0826) than 1 level (0.024), but as wind turbine at 3.056 m/s velocity the Savonius 4 level had worse efficiency (0.039) than 1 level (0.025) because the inertia load.

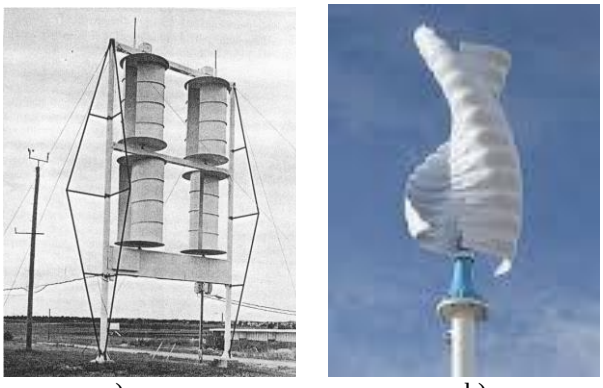
Keywords: *Savonius, efficiency, torque, 4 levels, sliding angle 45^o.*

1. INTRODUCTION

The energy and environmental crisis, where product carbon dioxide, causes global warming. This condition encourages the use of renewable energy (renewable energy) such as wind, water, ocean currents, geothermal, sun, etc. With the success of KEN 2005, Indonesia create the National Energy Paradigm where New & Renewable Energy will be used as primary energy and fuel energy becoming supporters. Savonius Turbine is a simple turbine that can be made by rural communities, so it needs to be assessed for its utilization. This turbine has the disadvantage of low efficiency and high vibration amplitude. In its development has been made twist blade turbine to reduce vibration, but its efficiency is decreasing. To repair this characteristic we make turbines with four blades storey, and each blade is shifted 45 degree. This aims study was finds moment characteristics, power and efficiency 4-storey Savonius turbine with 45 degree angle slide and compared with standard turbines.

2. BASIC THEORY

Savonius Turbine is a simple turbine consists of 2 blades like Figure 1a. The manufacturing is very simple so can be made by the rural communities. It was widely used turbine in rural areas although low efficiency turbine, high moment of inertia so that the work area at low fluid velocity (Figure 2). Another limitation is high vibration amplitudes turbine, but is better for a low fluid velocity. Savonius turbine development was made by twisted blade and partition blade (Figure 1b & Figure 3). The twisted blade can minimized the vibration amplitude, but the axial flow will reduce the torque and efficiency (Ref.1). Kamoji (Ref 2) has search, the partition blade maximum efficiency at 0.25 blade diameter.



a) b)

Figure 1. Savonius turbine; a) Savonius standard turbine, b) Twist turbine blade

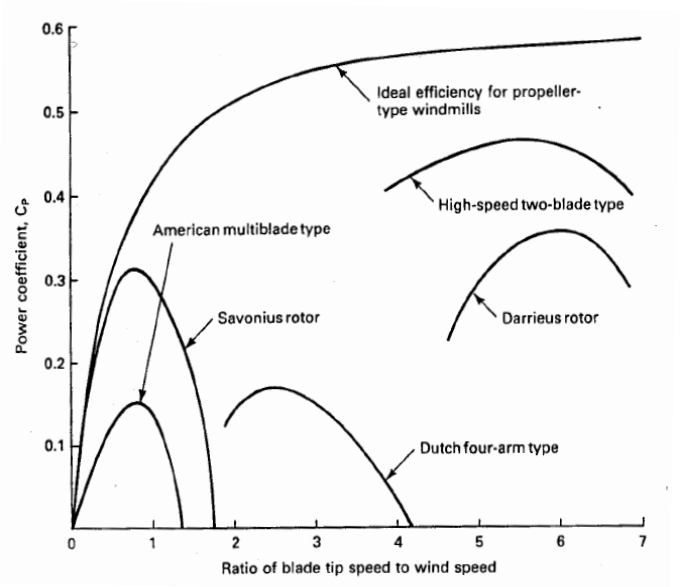
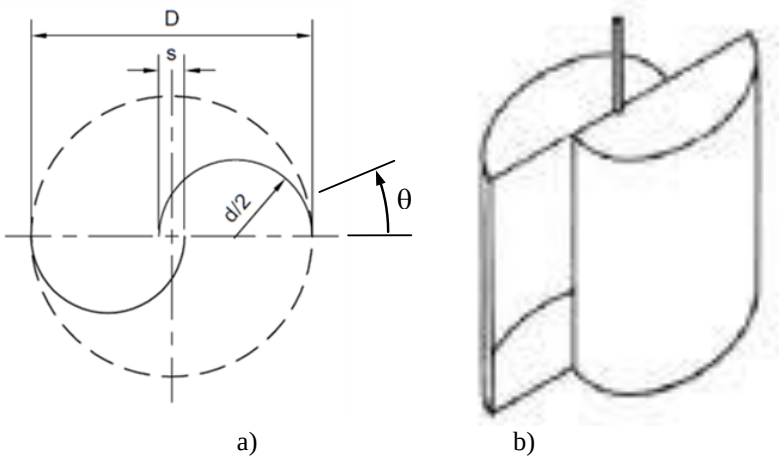


Figure 2. Work area a few turbines.



a) b)

Figure 3. Savonius Turbine with partition; a) Cross-section, b) 3-dimensional

To improve the turbine characteristic, blade twist and partition blade, we made 4-storey blade with 0.25 blade diameter partition and 45 degree sliding angle. We has been searched this model and the results, speed higher than standard turbines. However, the model cannot be mounted dynamometer which cannot be analyzed the moments, power and efficiency (Figure 4).

3. METHODOLOGY

3.1. Specimen.

One specimens is 4-storey Savonius turbines with 0.25 blade diameter partition and 45 degree sliding angle, second the standard one with 0.25 blade diameter partition (Figure 5)

3.2. Measurement device.

The measurements device is anemometer and discs brake dynamometer with a maximum of 5 kg spring force maximum.

3.3. Test Location.

Water energy test in Cokro Tulung Channel, Klaten Central Java and wind energy test in Parang Racuk, Baron Beach Wonogiri Gunung Kidul Yogyakarta. Another measurements device are anemometer to measure wind speed and water and wind velocity, tachometer for turbine rotational speed and turbine. The analysis was done by calculating moments, power and efficiency of the 4 partitions and standard turbine. Fluid velocity cannot be changed as the treatment variable, so analysis only performed on the fluid velocity there.

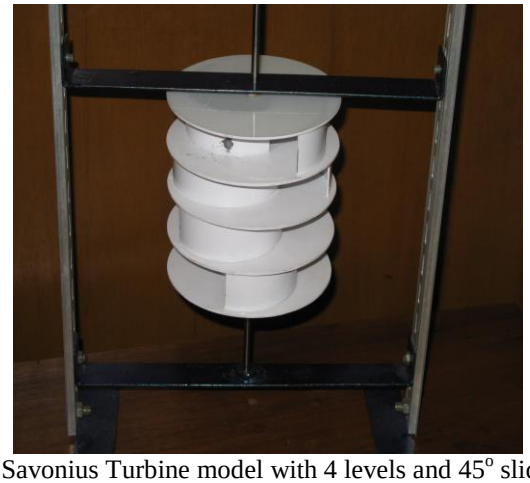


Figure 4. Savonius Turbine model with 4 levels and 45^{o} sliding angle.

a) b) c)

Figure 5. Turbines specimen; a) Savonius Turbine Specimens, b) Two researcher students, c) Disc dynamometer.

4. RESULT OF RESEARCH

On August 9, 2012 measure in both location, Cokro Tulung and Parangrucuk, but at Parangrucuk no wind flow. At September 11, Parangrucuk performed repeated measurements in the wind and there is even a relatively small. Turbine water datesWater velocity 0.3166 m/s.

a) b)

Figure 6. Turbine test; a) Wind turbine test in Parangrucuk, b) Water turbine test in Cokro Tulung

As wind turbine

	Standard	4 storey
Wind vel ,m/s	3.065	3.065
Turbine vel,rpm	65.01	58.55
Spring force, kg	0.007	0.005
Torque, Nm	0.0044	0.0031
Power, W	0.288	0.185
Efficiency, %	3.99	2.56

As Water turbine

	Standard	4 storey
Water vel ,m/s	0.316	0.316
Turbine vel,rpm	48.95	63.0
Spring force, kg	0.012	0.015
Torque, Nm	0.0076	0.0095
Power, W	0.371	0.598
Efficiency, %	5,14	3.99

5. CONCLUSION

1) As the water turbine Savonius 4-storeyl has higher speed and efficiency than standard turbine.
2) As the wind turbines at low wind velocity Savonius 4storey has low speed and efficiency, due to the inertia is very influential.

Suggestions: It's necessary to search with fluid velocity treatment variable, to obtain the whole turbine characteristics. However fluid dynamic laboratories with high speed, high cross-sectional area and a high discharge require a very high cost.

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