CHAPTER 5 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In this dissertation, robust design which was relatively simple to construct, was in essence the main criteria for the design improvement and development of the new generation of Thai sail windmill.

The original Thai sail windmill which is a type of low wind speed turbine, has been used for salt farming; normally the sail rotor diameter varied between 7 to 9 meters. These windmills are actually constructed from wood, bamboo and cloth materials which often carry 6 triangular sails, the rotor solidity is about 22% - 30%, the power transmission ratio is 1.25 - 1.5 : 1 to 1.33 - 1.67 : 1, fixed in azimuth at 15 to 30 degree from the north direction, rotating one way in the southwest monsoon and reversing direction in the northeast monsoon, power is transmitted by a chain coupled to a water ladder pump.

Laboratory scale tests were performed on a four blades, six blades, eight blades, and twelve blades of Thai sail rotor model (TSRM) to find the best rotor model and Archimedean's pipe-screw pump model (APSM), the pitch of Archimedean's pipe-screw considerate varied as follows: 0.6D, 0.8D, 0.6D, 1.0D, 1.2D, 1.4D, 1.6D, 1.8D and 2.0D.

It was found that the best of Thai sail Thai sail rotor model is 12B-T0 model and the pitch of Archimedean's pipe-screw is 1.4D for Archimedean's pipe-screw pump.

A large scale, the new Thai sail windmill was constructed. Its dimension were as follows: the overall size of the windmill, 9.0 m of height, is 2.5 x 2.5 x 2.5 m^2 of the base tower dimension, 8.0 m in diameter of rotor, 12 arms and 12 triangular sails. These specifications ensure that sails have a high starting torque. It could be coupled to water pumping applications with water ladder pump and Archimedean's pipe-screw pump. The windmills designed for multidirectional winds have a tail vane attached to the turntable. All materials had fit for the purpose intended with the main criteria being robustness from loads imposed from wind and other forces. The results provided as a performance of water pumping enables suitable applications to be suggested.

From the field test results of large scale, it was found that the performance of the prototype of Thai sail windmill 12B-T0 coupled to water ladder pump of wind speed was acceptable. The discharge rate varied between 8.04 - 49.58 m^3/hr at head of 1.0 meter in wind speeds varying between 1.5 - 4.5 m/s.

It was also found that the discharge of the prototype of Thai sail windmill 12B-T0 coupled to twelve Archimedean's pipe-screw pump of wind speed was increased depending on wind speed. The discharge amount varied between 9.56 – 38.23 m^3/hr at head of 1.5 meters in wind speeds ranging from 1.0 - 5.0 m/s.

The cost of material and the parts is about 150,000 Baht excluding the cost of machining and fabrication.

Finally it could be concluded that the new Thai sail windmill has many advantages despite its relatively moderate efficiency. On other hand; it is simple to design and construct and is also very robust, it is easily repairable and maintainable there would be little need for the services of a technician. All above advantages would help promote our new generation of the Thai sail windmill.

5.2 Recommendation

For the next research on the improvement of Thai sail windmill several suggestion as follows:

1. Test performance of the Thai sail windmill coupled to another windpump such as rope pump, Thai pump, etc.
2. To develop the tail vane for the safety system of Thai sail windmill.
3. To investigate the application of the Thai sail windmill for generating electricity.

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APPENDIX

A Picture of Thai sail rotor model (TSRM)

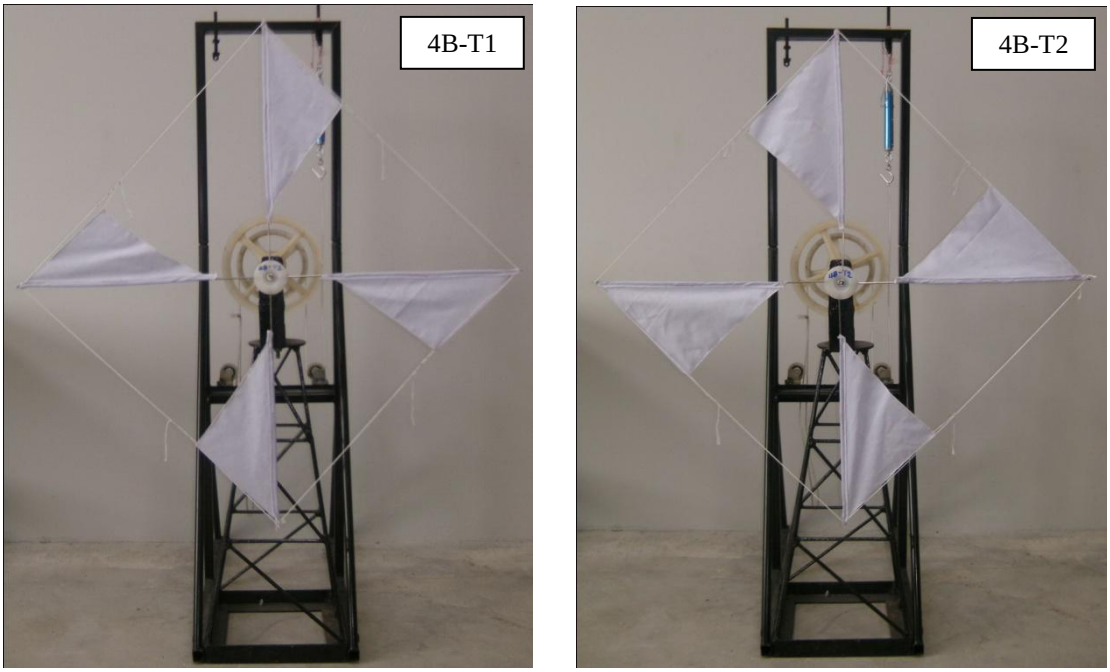

Figure A.1 Thai sail rotor model (TSRM) 4B-T1, 4B-T2

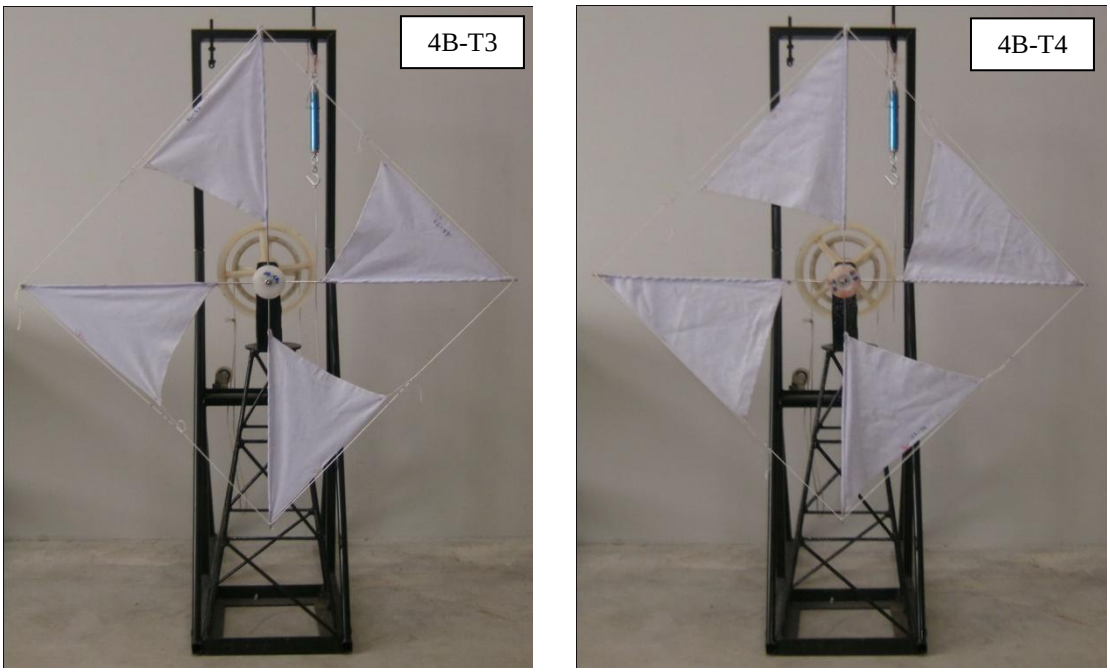

Figure A.2 Thai sail rotor model (TSRM) 4B-T3, 4B-T4

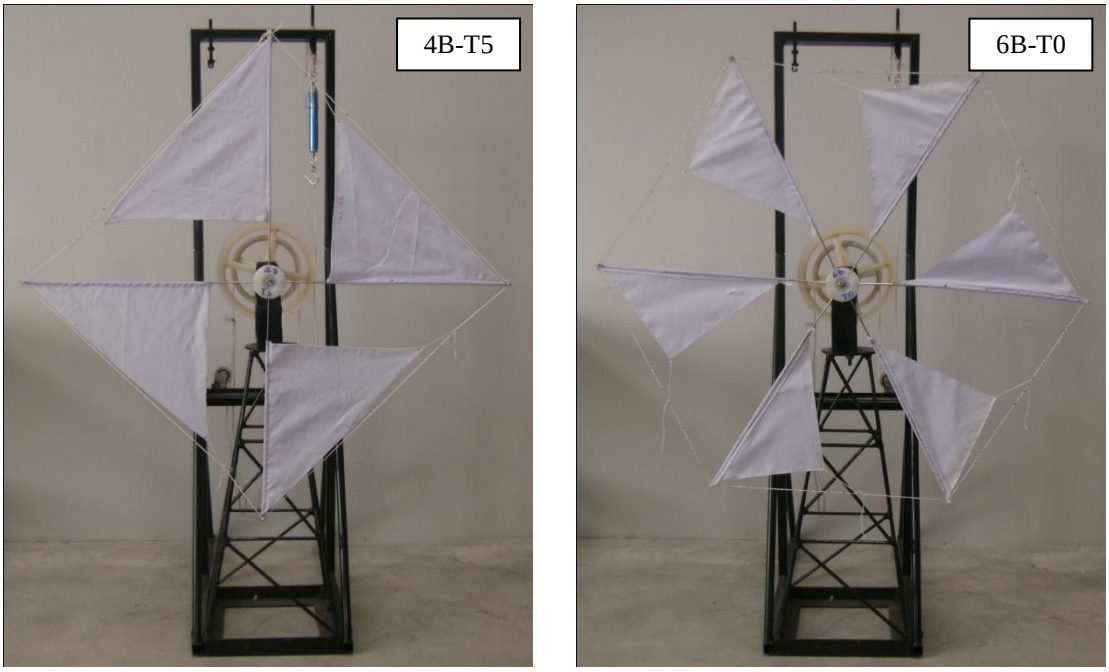

Figure A.3 Thai sail rotor model (TSRM) 4B-T5, 6B-T0

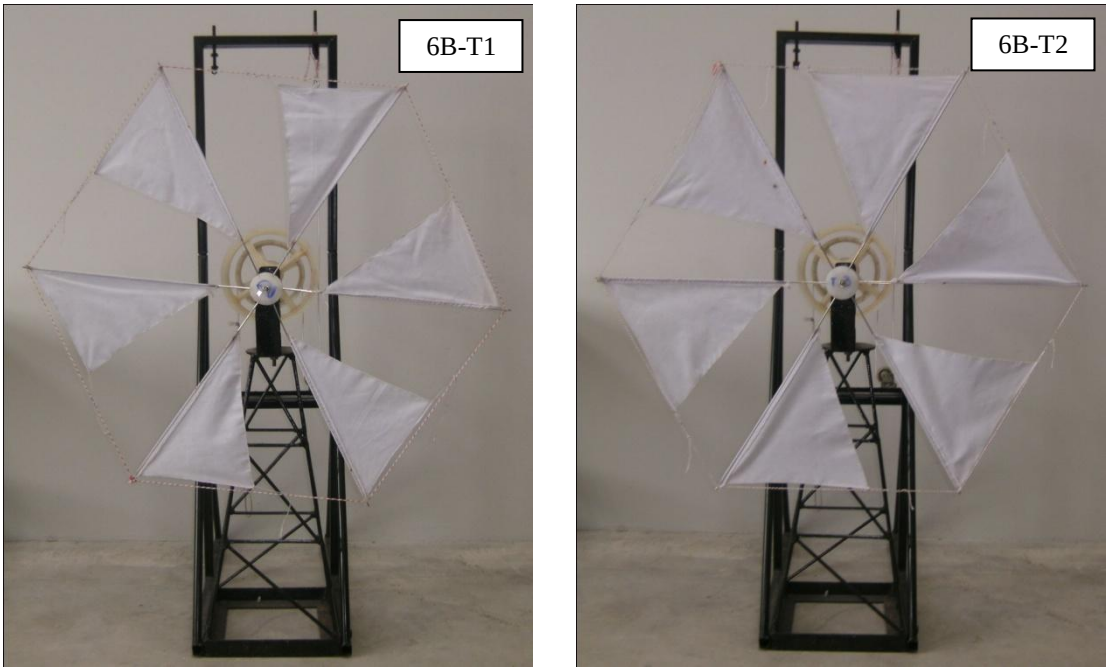

Figure A.4 Thai sail rotor model (TSRM) 6B-T1, 6B-T2

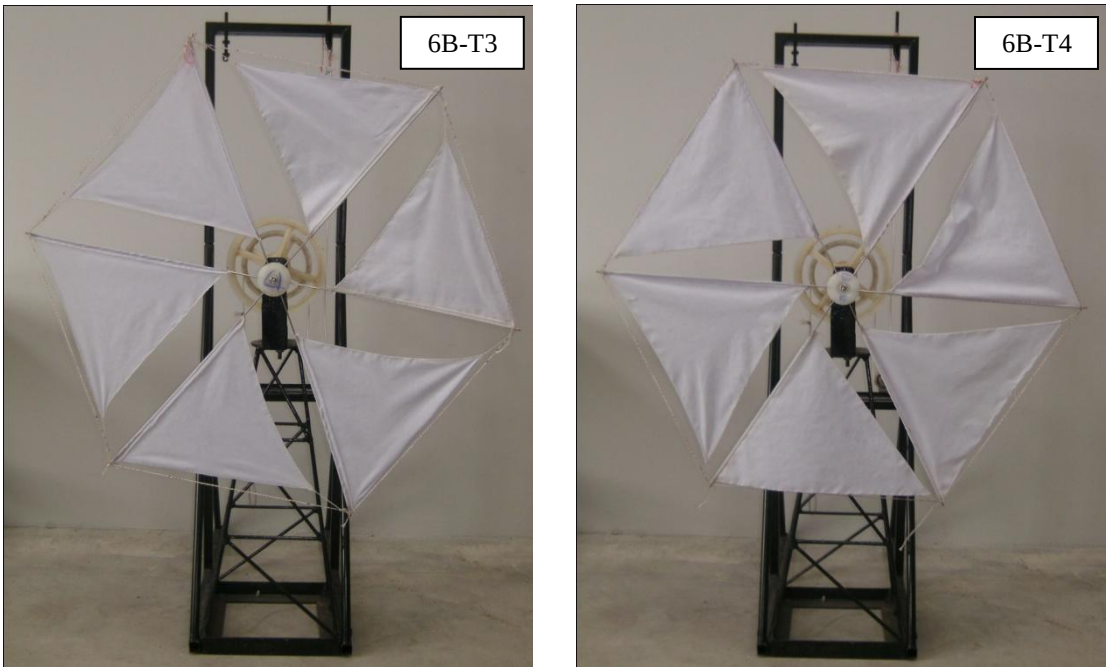

Figure A.5 Thai sail rotor model (TSRM) 6B-T3, 6B-T4

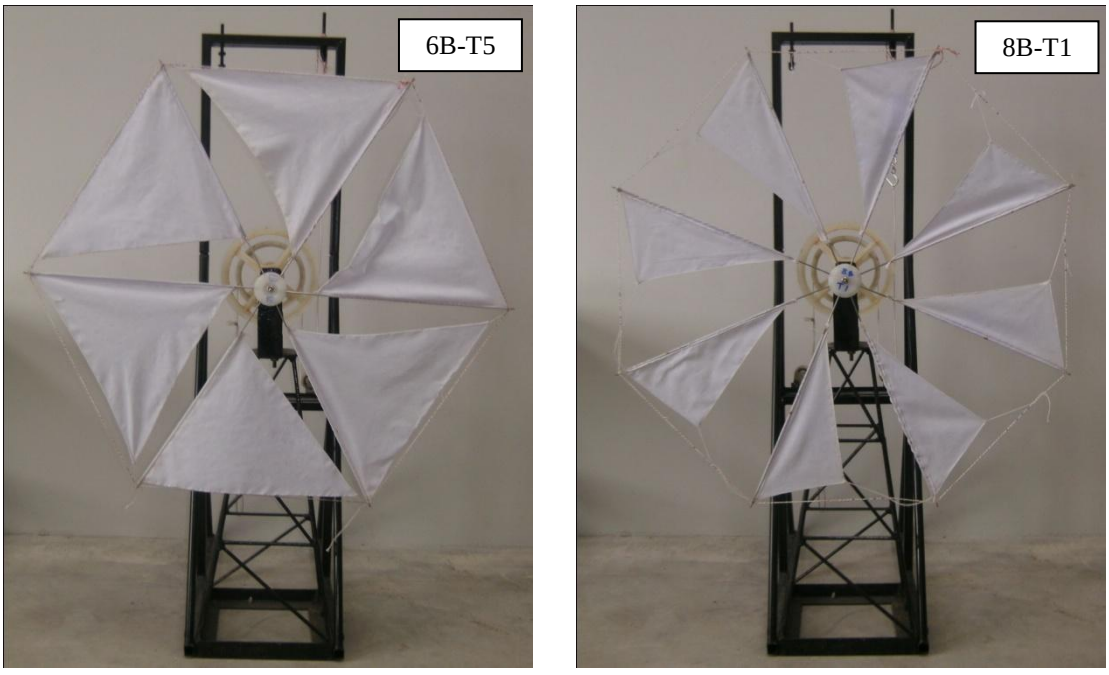

Figure A.6 Thai sail rotor model (TSRM) 6B-T5, 8B-T1

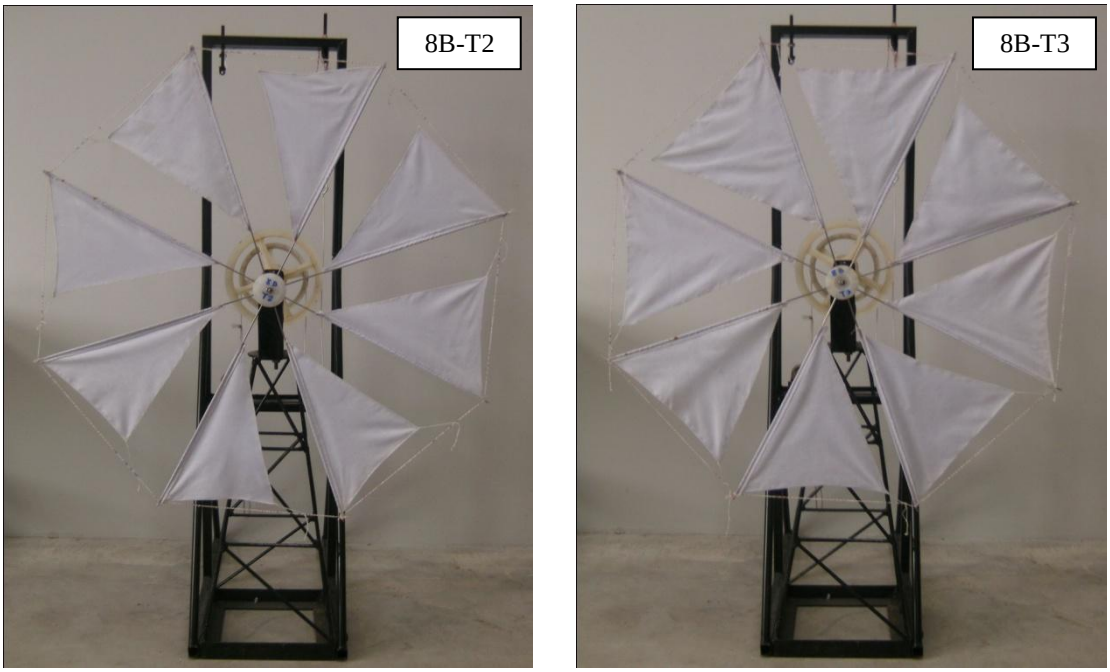

Figure A.7 Thai sail rotor model (TSRM) 8B-T2, 8B-T3

Figure A.8 Thai sail rotor model (TSRM) 12B-T0

Figure A.9 Thai sail rotor model (TSRM) 12B-T1

Figure A.10 Thai sail rotor model (TSRM) 12B-T2

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