BACKGROUND

In the world of rapid growing economy, energy consumption by power industry and human are drastically rising which is leading to an energy crisis situation. Today several countries are investing their resources on the development of renewable energy; wind power generation.

1. Pollution

Increasing carbon emission by industry and humans activities had impacted global climate which lead to increasing greenhouse gases at the atmosphere year by year regardless the campaigns and regulations initiated by the government and NGO.

2. Wind turbine’s design for offshore region

Design modification were done on wind turbine by engineers in order to adapt the wind speed of the desired geographical area. Researches indicates that, drag driven wind turbines such as Savonius and Darrieus configuration are suitable in harvesting wind energy in low wind speed potential.

3. Cost for harvesting energy

several countries took the step forward to go green and realize the potential in renewable energy, R.E were proven to be cheaper than non R.E in manufacturing and production cost

OBJECTIVE

To achieve the main objective of this study, three specific objective are presented as follows:

I. To design a novel bio-hybrid wind turbine relative to vertical-axis wind turbine’s configuration.

II. To characterized and study fluid flow field behaviour properties around the novel cavity vane design as drag type wind turbine through CFD analysis.

III. To investigate aerodynamics performance of proposed design relative to vertical-axis wind turbines aerodynamic design parameters through CFD analysis.

DESIGN HYBRIDIZATION of design 3

![Fig 1. Blade design adaptation: a) Blade design (top-view), b) Albatross Wing](image)

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- a) Blade design (top-view), 
- b) Albatross Wing

![Fig 2. Blade design adaptation: a) Blade design curvature and configuration, b) Pitcher Plant](image)

Fig 2. Blade design adaptation: 
- a) Blade design curvature and configuration, 
- b) Pitcher Plant

![Fig 3. Blade design adaptation: a) Blade facing upstream wind, b) Tulip Flower](image)

Fig 3. Blade design adaptation: 
- a) Blade facing upstream wind, 
- b) Tulip Flower

DESIGN ALGORITHM PROCESS FLOW

![Design algorithm process flow](image)

CONCLUSION

This paper investigated the numerical performance of three biologically inspired wind turbine based on power extraction and moment coefficient. Design 1 and Design 2 indicated a feasible power extraction wind turbine. As for Design 3 further design modification is required in order to reduce the high adverse pressure on the returning blade region. Design 3 indicated higher efficiency in power extraction in comparison to conventional Savonius wind turbine. The proposed blade of Design 2 outperformed Savonius wind turbine in moment coefficient by 4% at TSR=0.59. Meanwhile lift driven Design 1 turbine indicated stable power extraction at high RPM. However, in order to improve the performance of Design 1, the AoA of blade needed to be altered to ensure more lift is generated by the rate of change of momentum of flowing across the aerolfoil as it faces the freestream wind. Since the simulation is conducted in specific direction, experimental result will be validated against the simulation result in the future for validation and verification.

FUTURE WORKS

I. Study and experimental validation of CFD results.

II. Validate genetic algorithm with other designs.

III. Analyse geometry hybridization via novel genetic algorithm.

IV. Actual scale fabrications and testing.