Savonius Wind Turbine

Background
Usually, the Savonius rotor consists of two hollow half cylinders displaced from each other. It derives most of its power from the Force of drag. The force on the concave side of the rotor is higher, applying torque to the rotor. Lift is then caused from the thrust out the back face of the rotor. Suitability:
- Simple design
- Operates in varying wind conditions
- Does not need to be pointed to the wind
- Main components are placed low to the ground allowing for easy maintenance

Requirements
- Self starting
- Modular design, ability to be repaired
- Ability to test different designs easily by designing blades to be removable.
- Ease of Manufacture with given resources
- Sheet metal, composites, plastic resin, 3d print etc. We must design a shape we can make at this scale.
- Compatibility with wind speeds around UCI

Objective
- Power Fuel Cell
- Optimize the efficiency of the turbine's design
- Test various designs

Timeline
- Fall 2014: Test wind potential on campus, build prototypes
- Winter 2015: Acquire materials, test prototypes
- Spring 2015: Optimize and finalize design, manufacture

Maximum Power
\[ P_{max} = 0.36 \text{ kg} \cdot \text{m} / (\text{h}^2 \cdot \text{r}^2 \cdot \omega) \]

h = height
r = radius of the rotor

Angular Velocity
\[ \omega = \lambda \cdot \text{v} / r \]

\( \lambda = \text{tip speed ratio of Savonius} \)

Savonius and Flapping Panels inspired Vertical Axis Wind Turbine

Background
The design consists of Savonius inspired blades (curved panels blades similar to half cut-outs of a hollow cylindrical tube) attached to the crossed shaped rotor supports of a flapping panel wind turbine. Four-blades design is chosen because of its simplicity and highest efficiency (projected area) for each blade. The rotor will be driven by the drag force on the concave surfaces of the blades.

Suitability:
- Simple design
- All the advantages of a vertical-axis wind turbine such as:
  - Operates in vary wind conditions and directions
  - Does not need a yaw and pitch mechanism to wind direction
  - Main components such as generator and gearbox are placed near ground level for easy installation/maintenance
  - Only requires a relatively inexpensive structure that can support the weight of the blades with stability

Requirements
- Self starting or a compact & low-power starting mechanism
- Modular design to be able to integrate future improvements and designs modifications
- All the parts must be designed to be detachable
- Ease of manufacture with available resources
  - The blades will be designed with Sheet metals, composites, 3d printing, and off-the-shelf connection.
- Compatibility with wind speeds around UCI

Objectives
- Power batteries and fuel cell batteries
- Optimized the efficiency of Vertical Axis Wind Turbines
- Test various designs

Timeline
- Fall 2014: Test wind potential on campus, build blade prototypes
- Winter 2015: Acquire materials, implement and optimize gearbox, test and optimize prototype with different materials
- Spring 2015: Optimize and finalize design, build a finalized design

In a bigger picture, the wind energy project has the following expectations:
- Find an alternative and reliable source of energy
- Implement reliable wind powered generators in remote areas and developing countries
- Spread the technology by teaching people how to build small scale turbine for various projects and purposes

Group 1 members: Paul De Mesa, Alexander Cuenca, Harjot Purewal, Cole Gnadt, Athanasios Kaplanis, Siravit Vuttipongmanee

Group 2 members: Weifu Wang, Hyunjin Cho, Qikai Li, Qihao Liu, Sangeem Park, Zhiqiang Shen, Liang Jiang, Xu Zheng, Ziwei Li