# DARRIEUS WIND TURBINE

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ECE 4803 – DEVICES FOR RENEWABLE ENERGY

CREATING THE NEXT

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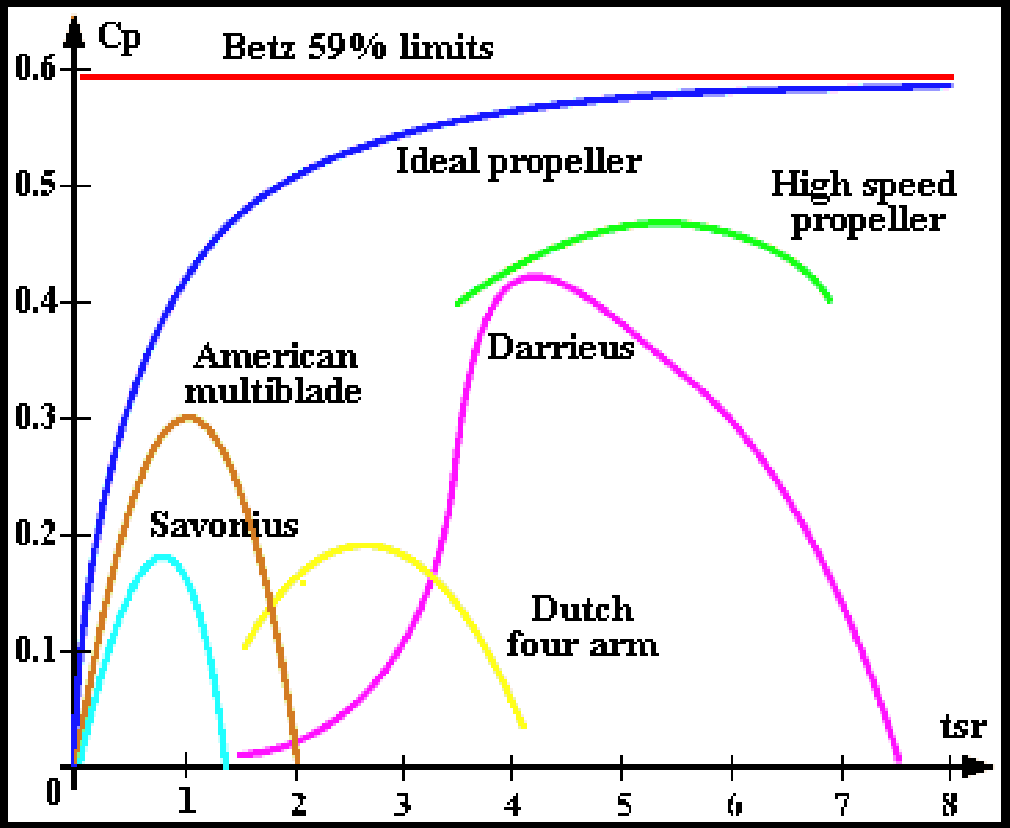
# WHAT IS DARRIEUS WIND TURBINE?

- Vertical axis wind turbine (VAWT) generator
- Consists of a number of curved aerofoil blades
- Not self-starting turbine – Needs small powered motor to start off the rotation

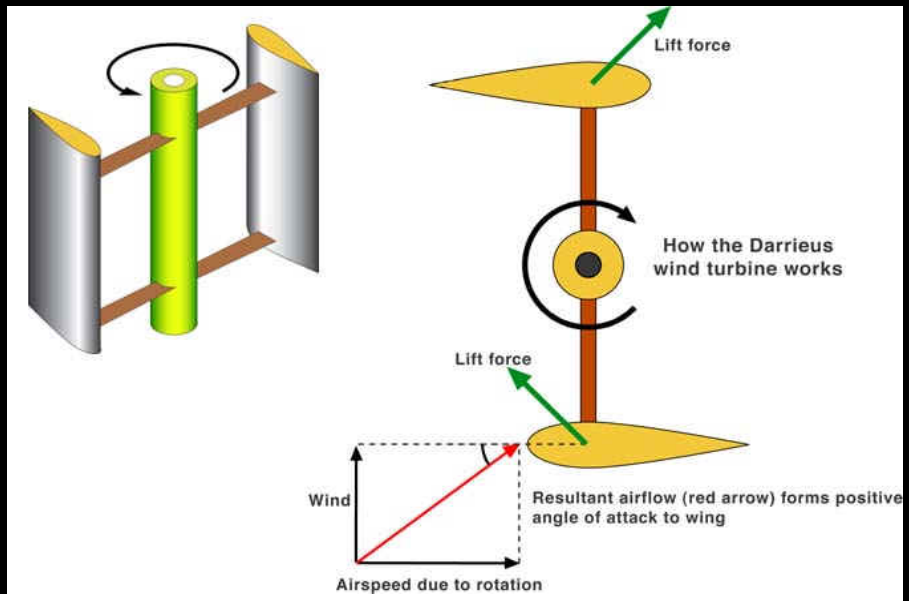
# WHY DARRIEUS WIND TURBINE?

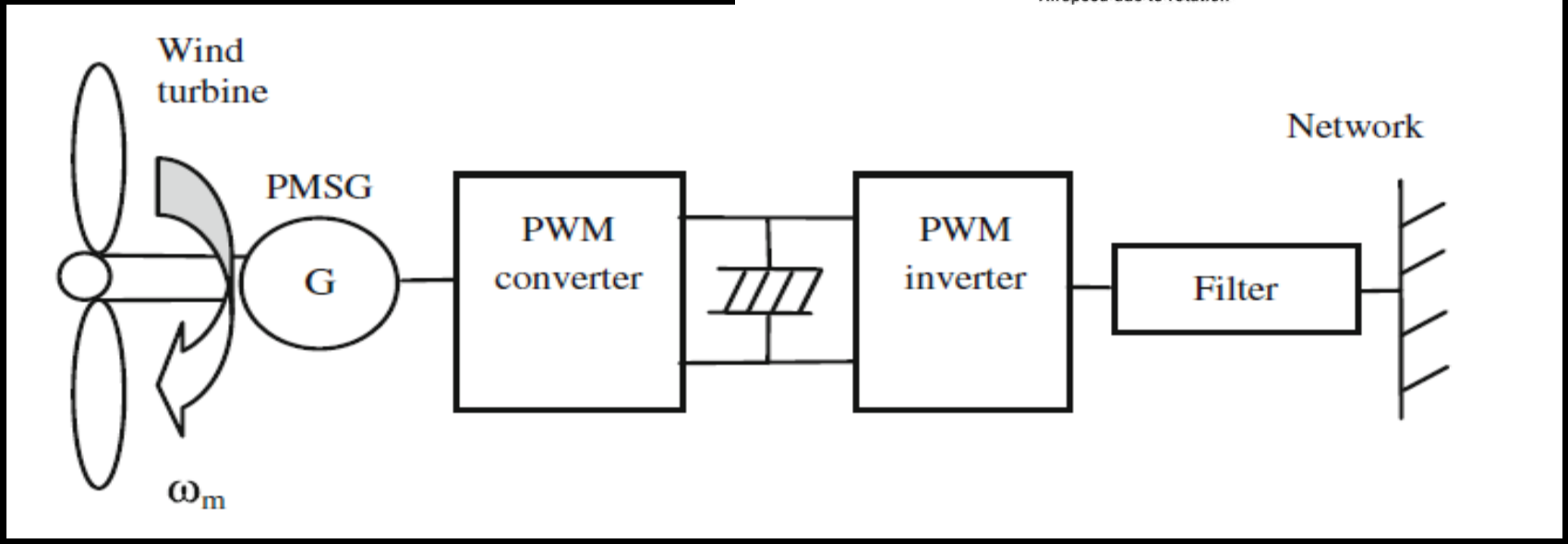
- Small in size
- Ideal for sites with unpredictable weather patterns.
- High efficiency – 40%
- Can spin at many times the speed of the wind
- Generates less torque than Savonius and rotates faster
- The gearbox and electrical generator are located on or near ground



# HOW DOES DARRIEUS WIND TURBINE WORK?

- Wind
- Blades start rotating
- Rotor spinning



# TECHNICAL SPECIFICATIONS (QR5 WIND TURBINE)

| | |
|---|---|
| Physical dimensions | 5m high x 3.1m diameter |
| Generator | Direct drive, mechanically integrated, weather sealed 6 kW permanent magnet generator |
| Power control | Peak power tracking constantly optimizes turbine output for all sites and wind speeds |
| Operation mode | Max wind speed: 16m/s; Min wind speed: 4m/s |
| Design lifetime | 25 years |
| Rotor construction | Carbon fiber and epoxy resin blades and connection arms |
| Brake and shutdown | Overspeed braking above 14 m/s wind speed<br>Auto shutdown in high wind speeds above 16m/s |
| Roof mounting | Minimum recommended height above buildings: 3 m |
| Tower mounting | Minimum mast height: 9m to bottom of blades |
| Remote monitoring | Event log can be accessed via PC. Remote monitoring stores operation and kW hours of electricity generated |

# POWER OF WIND AND MECHANICAL POWER

Factors that matter in power of wind calculation are:

- Turbine size – Related to area of segment of wind being considered (m^2): A
- Undisturbed wind speed (m/s): u
- Air density: ρ

$$Pw = ½ \rho A(u^3)$$

Mechanical Power:

$$Pm = ½ \rho (16/27) As (u^3)$$

where *Pm* is mechanical power (W) and As is:

$$As = (Dt) (lb)$$

Where

- As: swept area (m^2)
- Dt: diameter of the turbine (m)
- lb: length of the turbine Blades (m)

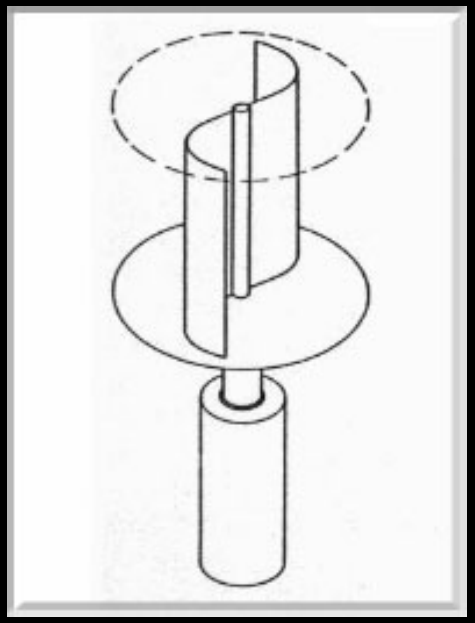
So we can re-written as: $Pm = Cp * Pw$

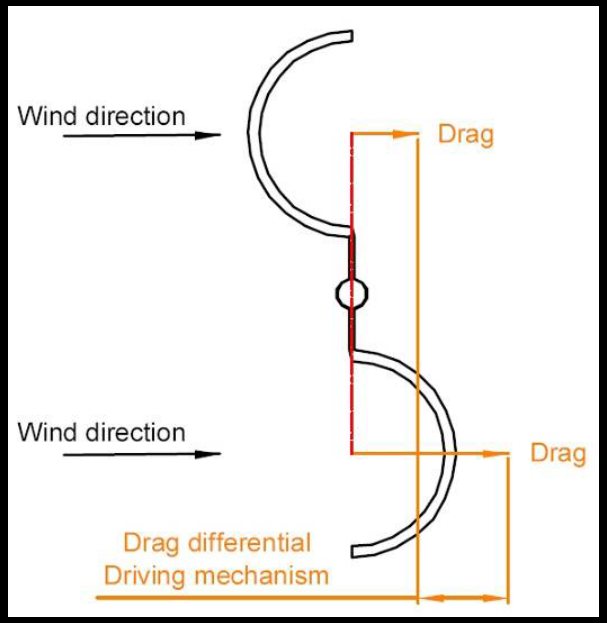
# DARRIEUS WIND TURBINE DESIGN

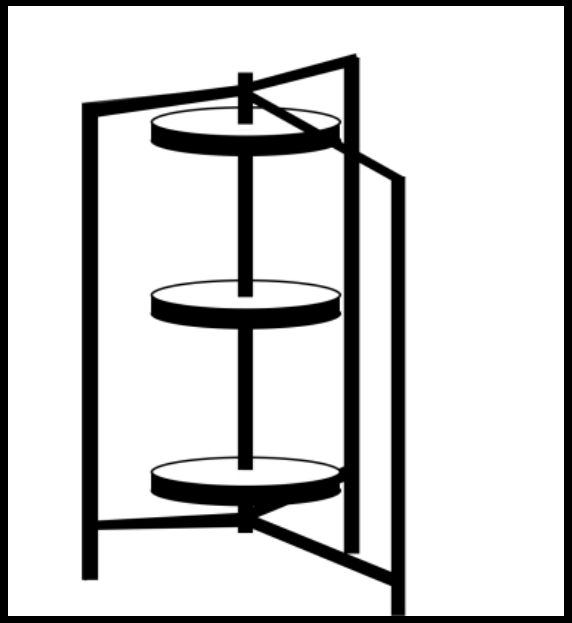
- Shape
- Transmission system
- Frame – A housing to hold the blade assemblies and the transmission system

# SHAPE

- Symmetrical blades
- S-Shape (Savonius Turbine)
- H-type Rotor Darrieus





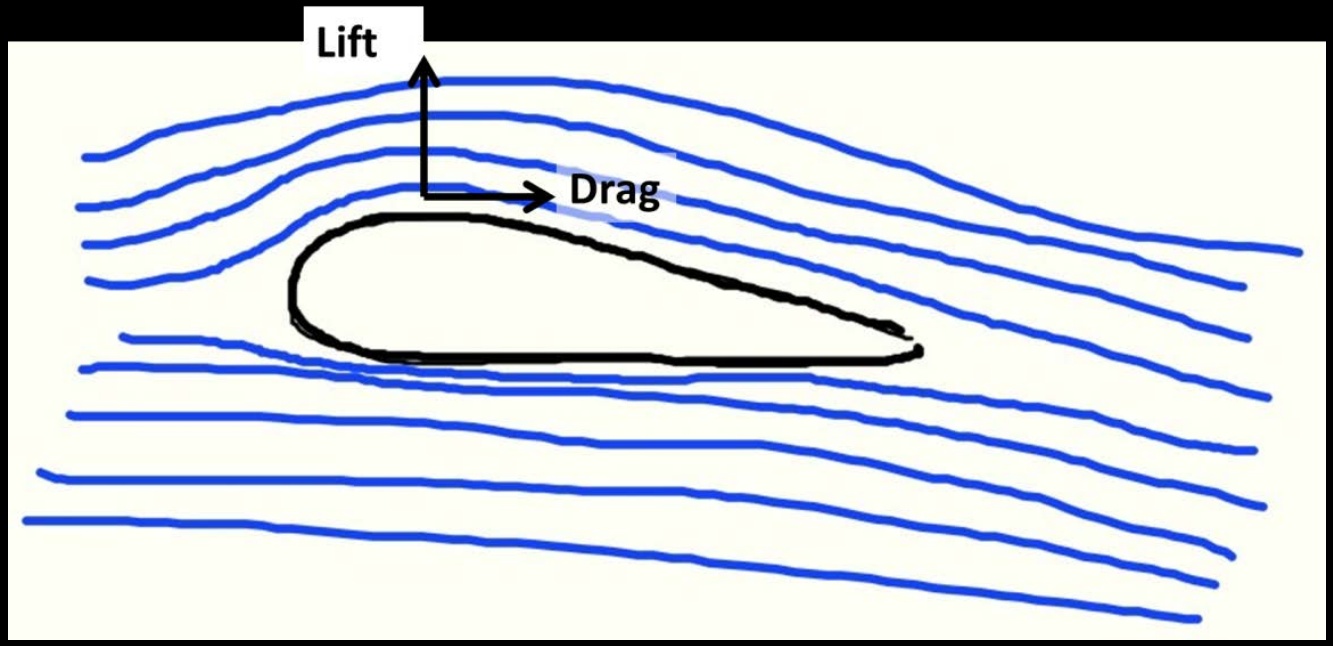



# TRANSMISSION SYSTEM

- Bike Transmission
  - Transmission from the shaft of the turbine to the generator was initially designed to use many parts from a bike transmission.
- Friction band along the outside of a bike wheel to connect the generator and turbine

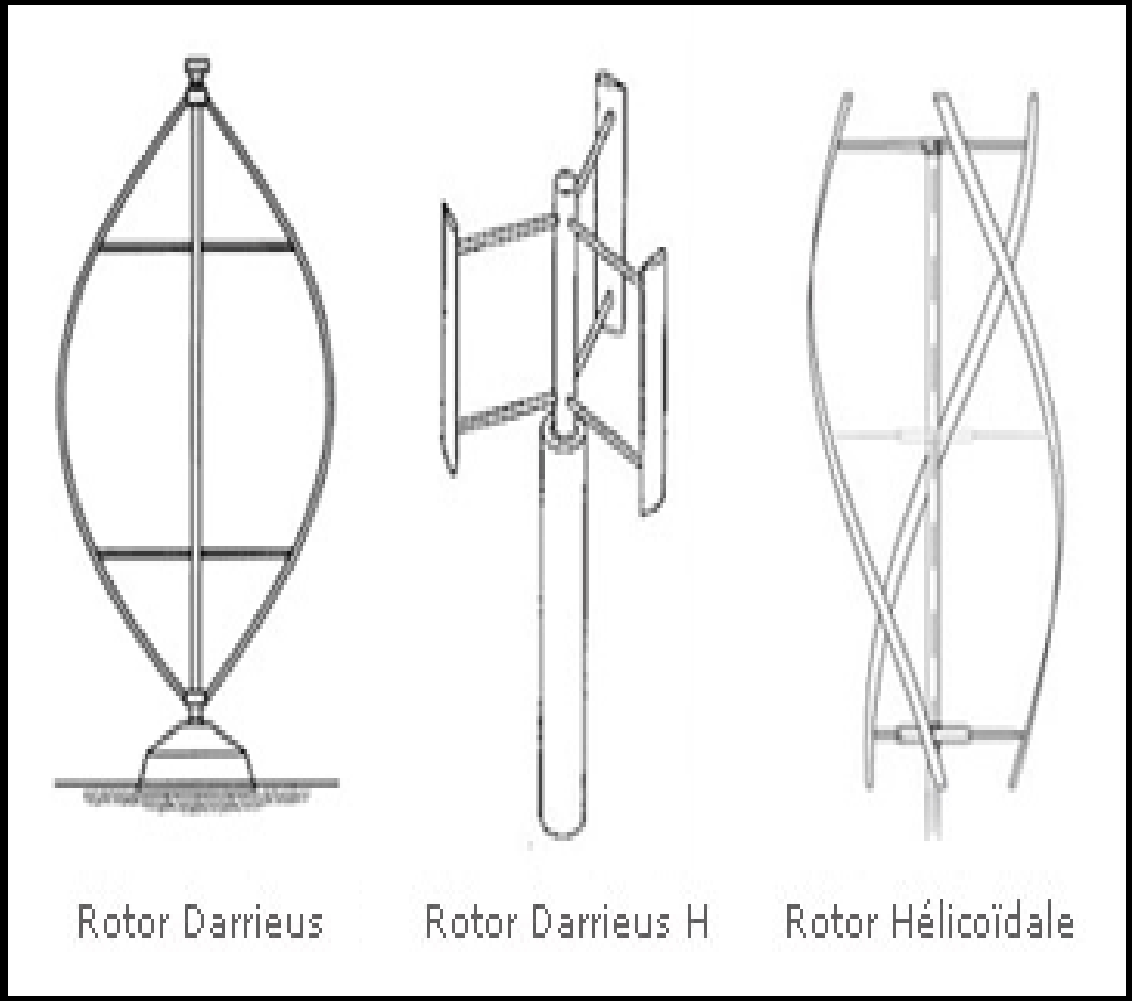
# FRAME

- Limit amount of wind blocked
- Allow maximum force from the wind



# DARRIEUS WIND TURBINES

3 different design of darrieus wind turbines



# REFERENCE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