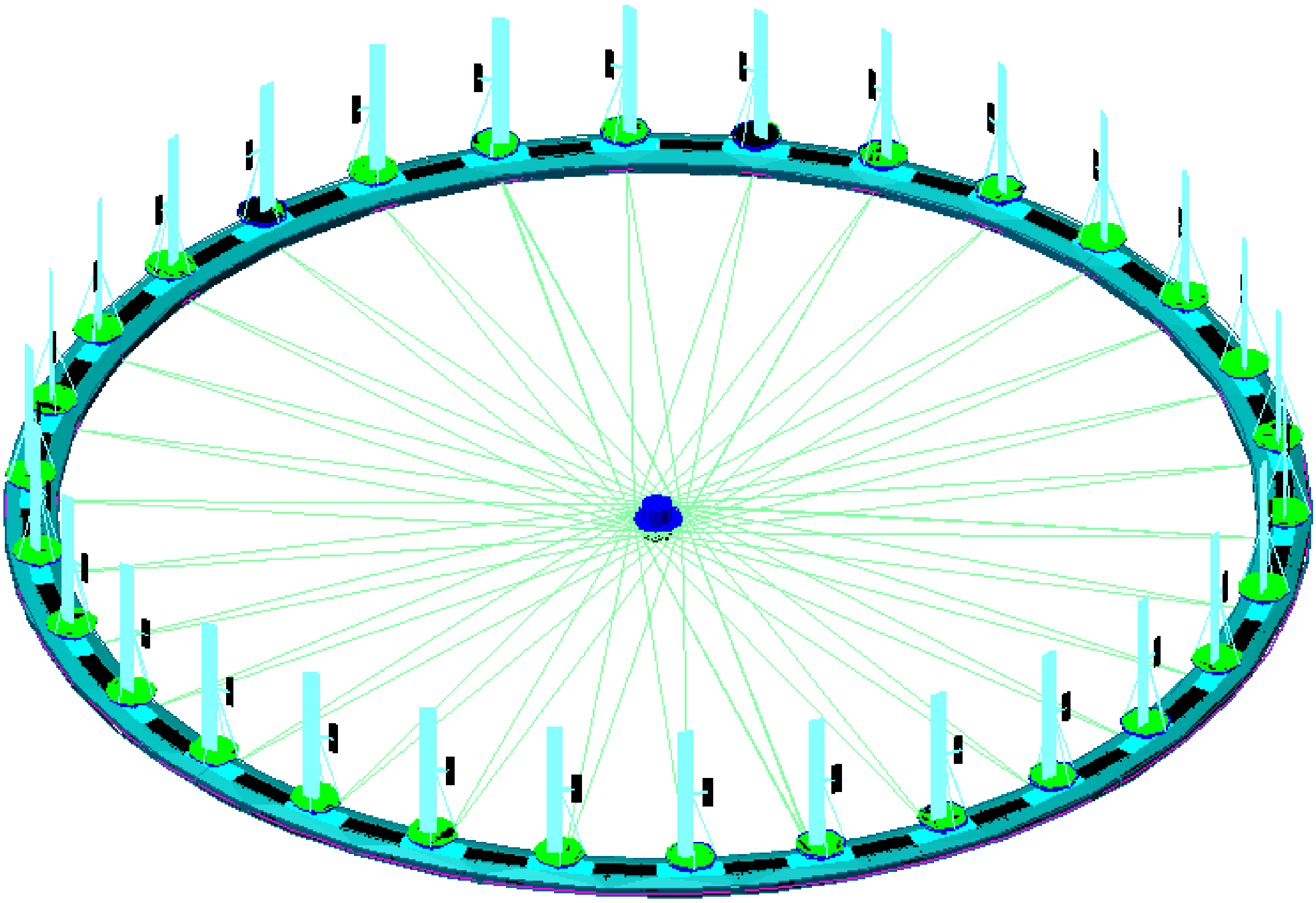
Vertical Axis Wind Turbine



Design Concept

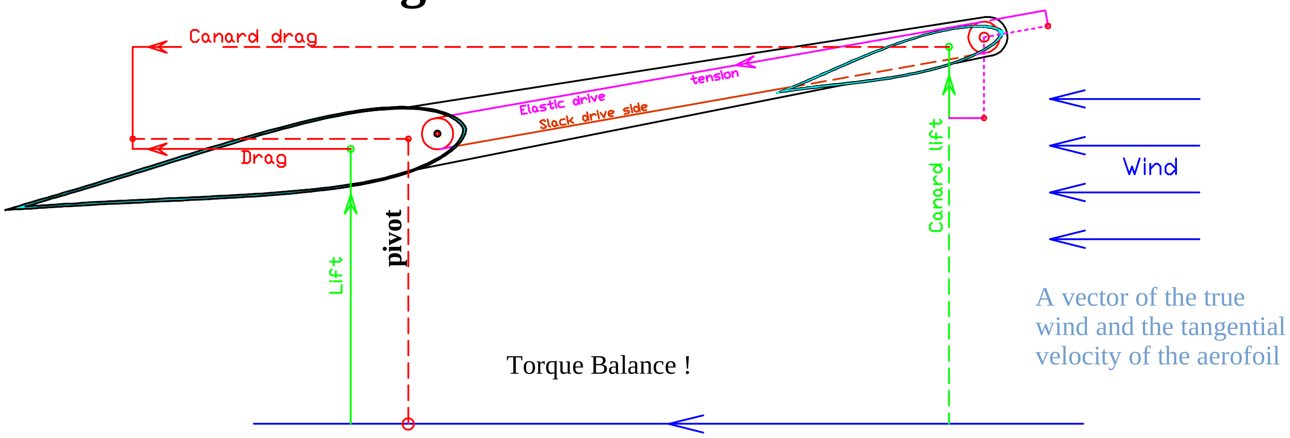
Wind energy Harvesting for Storage and power generation

Traditional VAWTs have aerofoils mounted on arms rotating round a central tower. This restricts the size and potential power of these VAWTs.

The new concept has the aerofoils mounted on a floating flywheel which is connected to a central hub, within which power can be generated. The mounting of the aerofoils is such that they can be fully feathered into wind when required and independently angled to the apparent wind for optimum energy Collection. The use of a floating flywheel removes the weight from the centre and opens the door to the potential of really massive plant scales which would dwarf existing wind turbines.

The main advantage is that the floating flywheel stores energy during periods of higher wind speeds. The stored energy boosts the power generation during periods of slower wind speeds. This feature greatly enhances the power production at any site at which the wind speed varies.

How the new design works:



The lift and drag forces on aerofoils are dependent on (speed of the wind)^2 and vary with the angle of attack (AOA) within an operational range. These forces can be considered as acting through its centre of pressure at about the quarter chord position.

In the new design each aerofoil is mounted such that it pivots in front of its centre of pressure and incorporates a smaller control aerofoil (canard) mounted in front of it driven by an elastic drive. The torque from any tension on one side of the elastic drive causes the canard to rotate creating an AOA resulting in a **balancing** torque due to canard lift and drag forces.

The lift and drag forces of the canard cause the aerofoil to rotate (creating an AOA) until a **balancing** torque is generated by the lift and drag forces of the aerofoil.

The control drive in normal operation switches the tension from one side to the other as the aerofoil, which is on a moving diameter, (driven round by the lift forces) goes from the windward to leeward side and back again as it re-enters the windward side.
It can also remove all tension allowing the aerofoil to fully feather into wind.
Special features of the drive (not shown here) allows for the force of the wind to reduce the AOA increasing tension and torque up to a maximum level, beyond which the AOA of the canard reduces against a lowering of the AOA driving torque.
This feature allows for increasing wind speeds to create increasing lift forces on the aerofoils at reducing AOAs up to a maximum designed level, beyond which increasing wind speeds result in smaller lift forces.

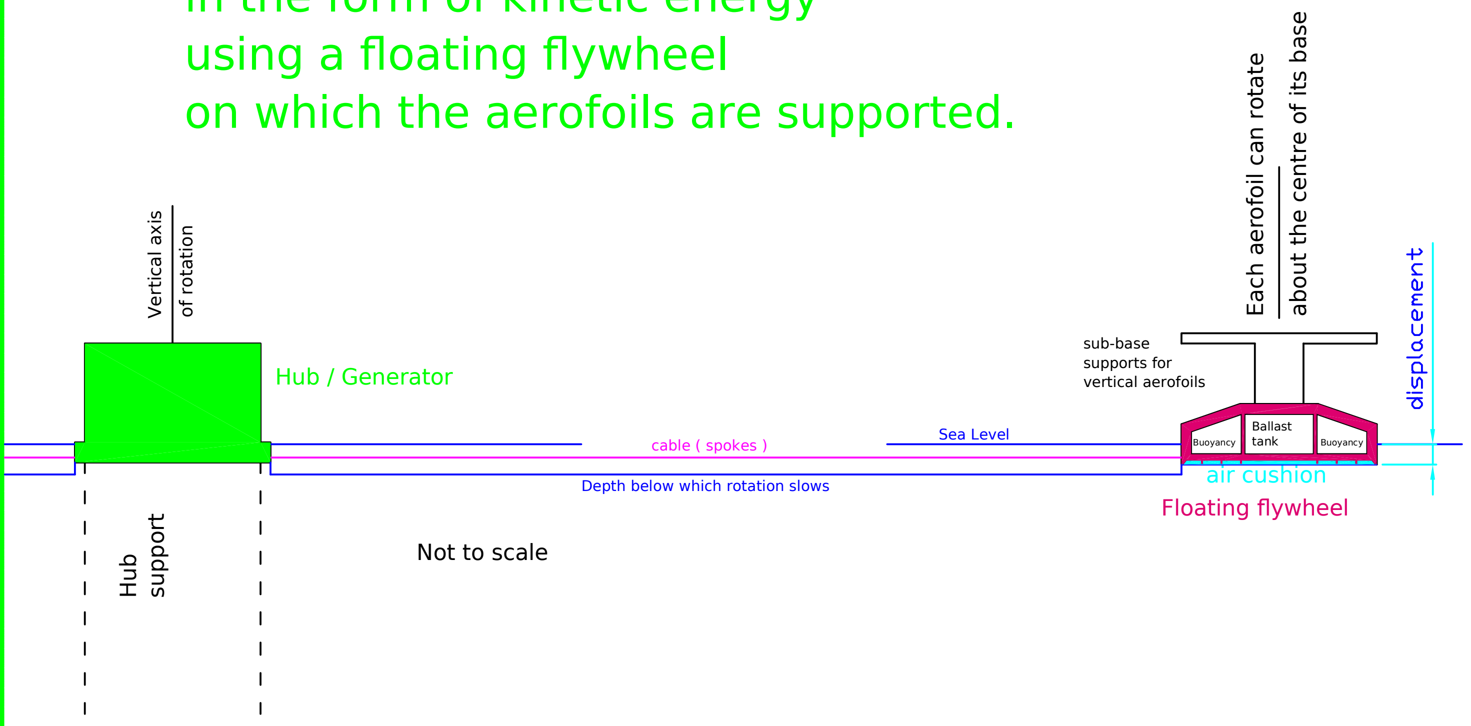
As the AOA reduces due to increased wind speed (which can be due to increased tangential velocity) The lift to drag ratio decreases dramatically, resulting in more drag for the same (or less) lift, which creates an aerodynamic brake.

The moving diameter is a floating flywheel, which includes a cushion of air and unlike a ship there is no form drag, as the water does not need to be pushed aside.
The energy to overcome the viscous drag on the outside of the rim is not retained and the force to overcome the viscous drag increases with speed.

The combination of aerodynamic brake and increasing viscous drag prevents a run away Scenario, but allows for operation in any wind condition.

The control of the AOA is mechanical eliminating the risk of electrical system failure in potentially adverse conditions.

Renewable energy storage in the form of kinetic energy using a floating flywheel on which the aerofoils are supported.



The flywheel speeds up when the energy extracted from the wind is greater than that generated.
The flywheel slows down when the energy generated is greater than that extracted from the wind.

Kinetic energy stored 3.48 GWh
when (tip speed)
aerofoil tangential velocity = 25 metres / second

with the aerofoils on a 2500 metre diameter
and flywheel displacement of 10 metres.

Only the top 15 metres of sea trapped within internal diameter of the floating flywheel is calculated as being part of the fluid flywheel.

The difference in energy stored between a tip speed of 24 m/s and 25 m/s is 273 MWh