

# Wake and Wind Farm Aerodynamics of Vertical Axis Wind Turbines

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## Background & Motivation

Society's increasing energy demand, within sustainable constraints, drives wind energy growth. Research shows that a Vertical Axis Wind Turbine concept (VAWT) can be 30% cheaper than the conventional Horizontal Axis Wind Turbine, if we can demonstrate its effectiveness in the complex wind farm flow/inflow. To support this engineering challenge, we need develop dedicated scientific formulation of the flow physics of VAWT, of which the flow phenomena are more complex than the ones found in HAWTs due to the complexity of the 3D unsteady rotor.

The research intends to push the state of the art of the analytical, experimental and numerical modelling to the 3D unsteady interaction of the rotor with in flow and wake systems in a wind farm. In doing so, we aim to answer the research questions listed as follows.

## Research Questions

1. How to model the wake recovery of a VAWT?
2. How to control the trajectory and recovery of the wake of a VAWT?
3. How to implement and use the models to optimise a VAWT Wind Farm configuration?
4. How to experimentally measure the wake evolution of a VAWT and validate the models?

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## Research Methods

- Different fidelity analytical or numerical simulation methods like vortex model and CFD
- PIV experiments

