



# TRANSFORM

## Energy Systems through Game-changing Technology

BUILDINGS | CARBON CAPTURE AND STORAGE | FUEL CELLS | NUCLEAR | POLICY | PLANNING  
RENEWABLES | SMART GRID | STORAGE | SUSTAINABLE MOBILITY | SUSTAINABILITY ANALYSES



## INTO THE VORTEX: INVESTIGATING FLOW OVER AIRFOILS AT LOW REYNOLDS NUMBERS

**Serhiy Yarusevych**

Scientists and engineers understand how air behaves when it flows over airplane wings and wind turbine blades at high Reynolds numbers - a ratio that involves wind speed, airfoil dimensions and the viscosity of the surrounding air.

However, we know much less about its behaviour at low Reynolds numbers - numbers often encountered by small-scale wind turbines.

That's where UW researcher Serhiy Yarusevych comes in. In a series of wind tunnel experiments, Yarusevych and his group used flow visualization and quantitative measurements to investigate key physical phenomena occurring over an airfoil at different Reynolds numbers and angles of attack.

In particular, they focused on two common scenarios where the airflow separates from the turbine blade, creating a shear layer. In one case, the shear layer never reattaches but instead generates a wide wake. In the other, the shear layer reattaches, creating a "separation bubble" in the process.

In both scenarios, the researchers discovered that shear layer transition to turbulence and the associated formation of vortices play a key role in flow development. They also found that vortices formed in the airfoil wake, which may lead to undesirable noise and vibrations.

As wind energy becomes increasingly popular, fundamental insights gained into these phenomena will help researchers design effective flow control methods, enhancing performance, reducing noise, and preventing structural vibrations.

Partners: Bombardier Aerospace