Summary: Vertical axis wind turbine with integrated centrifugal flaps

The aim of our project is the development and construction of a hybrid of lift- and resistance-based wind turbine. Centrifugal flaps should help the vertical wind turbine to start up better at low wind speeds. Compared to the regular lift-based turbine, this concept achieves a significantly higher starting torque and does not require any complicated cybernetics.

During the first test runs in the wind tunnel, the fact was confirmed that lift-based wind turbines cannot accelerate well from a standstill. To solve this problem, resistance-based and lift-based rotors are often combined into so-called hybrids. However, most hybrids have the disadvantage that they cannot achieve the same efficiency factor as pure lift-based rotors. A start-up system that switches off at a certain rotation speed and does not have any impact on the efficiency would be the optimal solution.

Our hybrid, which represents such an optimal solution, is characterized by aerofoils with integrated split flaps, which are opened by repelling magnets at stillstand. The result: the rotor starts up much easier and at lower wind speeds. As the rotor accelerates the magnetic opening effect is overcome by the centrifugal forces, which act on the flaps. As a consequence, the flaps fold in automatically.

By doing this the wind turbine works at low speeds by using the resistance principle and at higher speeds by using the buoyancy principle. Without any complex mechanics and control techniques, the turbine always works in the optimum operating range.

Several models with the integrated centrifugal flaps and the rotor profile described were built and measured in the wind tunnel. The tests showed that the starting torque is significantly increased by the open flaps, which promotes the starting of the rotor from standstill.

Comparable to conventional lift-based rotors, our newly developed wind turbine generates an approximately 600% higher starting torque and thus a significantly higher overall efficiency in the desired conversion of wind into electricity.