

The improved Savonius wind turbine captures wind in the cities

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Windside wind turbine

A Finnish invention, a vertical axis Savonius wind turbine, can be further improved, according to a new study from the University of Vaasa.

Mechanical modification of the [rotor](#) increases the power coefficient by

around 8 percent (2 percent units). The power coefficient is the ratio of the power extracted by the rotor to the available kinetic power in the air flow.

According to doctoral thesis of Svetlana Marmutova, University of Vaasa, the variation of the power coefficient under gusty [wind](#) conditions depends on the level of gustiness: the higher the gustiness, the more stable the power coefficient.

"It is a good feature, since wind in cities is gusty and stable rotor operation is favorable," says Marmutova.

Marmutova also studied the effect a Savonius turbine can have on radar operation.

Low noise level is an advantage

The Savonius wind rotor was invented by Finnish marine engineer Sigurd Savonius in early 1920s. Initially, Savonius proposed to use the rotor for sailing, water pumping, ventilation and power generation using air and water. Today, Savonius wind turbines have many modifications.

Generally, wind turbines can be classified as vertical axis (VAWT) and horizontal axis (HAWT), depending on the axis of rotation. Most wind turbines in widespread use are the HAWT variety.

Among the advantages of a [vertical axis](#) Savonius wind turbine are low noise level, the ability to operate with low wind speeds and relative independence on the wind direction and simplicity of maintenance and manufacture of the turbine. Basically, the simple rotor can be obtained by cutting any cylindrically shaped object and moving the parts sideways along the cutting plane. However, the rotor has a low power coefficient and power output in comparison to HAWTs.

"Nevertheless, Savonius [wind turbines](#) can provide a good solution for [wind power generation](#) in cities due to their size and lesser sensitivity to the changes in wind speed and direction in comparison to HAWTs," says Marmutova.

In the frame of the study, conducted in the University of Vaasa, some aspects of Savonius wind turbine operation in urban areas were considered. The proposed modification adds a plane in the center of a rotor, which decreases the pressure behind the advancing blade, thus increasing the lift force. Thus, a Savonius rotor is a drag and lift device. The advancing blade is the blade that moves in the direction of the incoming wind.

Savonius rotors may affect radar operation—basically, radar operation is based on the return time of emitted signals; thus, the presence of a target and its distance can be obtained. However, any objects in the signal path cause sort of "blind zone" for the radar. The size of this zone depends, evidently, on the object dimensions and material. These results were obtained using the computational fluid dynamic (CFD) analysis and Ansys Fluent and Comsol Multiphysics applications. Statistical analysis of the wind regime was done using the wind speed measurements performed in the University of Vaasa campus area.

Provided by University of Vaasa

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