# Superconducting wind turbine chalks up first test success

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A superconducting rotor has been successfully tested on an active wind turbine for the first time.

The EcoSwing consortium designed, developed, and manufactured a full-size superconducting generator for a 3.6 megawatt wind turbine, and field-tested it in Thyborøn, Denmark.

They report their results in the IOP Publishing journal *Superconductor Science and Technology*.

Corresponding author Anne Bergen, from the University of Twente, The Netherlands, said: "Wind turbine size has grown significantly over the last few decades. However, today's technology has trouble keeping up with the trend towards ever-increasing unit power levels.

"Permanent-magnet (PM) based direct-drive (DD) generators offer a solution in state-of-the-art multi-megawatt generators, but the feasibility of 10+ megawatt PM-DD turbines requires significant weight reduction. Pseudo-magnetic direct-drive (PDD) machines, integrating magnetic gearing and generator functions are a possible solution to this, but they can be expensive and highly complex to produce."

To tackle this challenge, the team employed rare-earth barium copper oxide (ReBCO) high-temperature superconducting generators. These require a smaller amount of rare-earth materials than PM machines, resulting in a lower cost. Superconductors can also carry high current densities, which results in more power-dense coils and a lower weight.

Ms Bergen said: "The field test of the generator was extremely successful. When the generator was installed at Thyborøn, the turbine achieved its targeted power range, including more than 650 hours of grid operation. This shows the compatibility of superconductive generator technology with all the elements of an operational environment such as variable speeds, grid faults, electromagnetic harmonics, and vibrations.

"The project made several other substantial pieces of progress. It

demonstrated that HTS coil production is not limited to specialised laboratories, and constitutes a successful technology transfer from science to industry. The HTS rotor was also assembled in an industrial setting, showing superconducting components can be deployed in a 'standard' manufacturing environment.

"Now the concept has been proven, we hope to see superconducting generator technology begin to be widely applied on wind turbines."

**More information:** Anne Bergen et al, Design and in-field testing of the world's first ReBCO rotor for a 3.6 MW wind generator, *Superconductor Science and Technology* (2019). DOI: 10.1088/1361-6668/ab48d6

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