

Next Generation Drive Train - Superconductivity for Large-Scale Wind Turbines

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Abstract - GE proposes to apply transformational technology in the form of low temperature superconductivity (LTS) to the design of a direct-drive wind turbine generator at the 10-MW power level—a design concept that is also beneficial at lower power levels, but leverages the maximum benefits of superconductivity that are usually obtained at higher power levels. Utilizing superconducting technology for these generators, reduces weight on the top of the wind turbine tower and the larger intended power levels of these machines, coupled with their improved wind-to-electrical energy conversion efficiency can also lead to economies of scale (e.g., fewer towers for a given wind-farm output). GE's LTS machine design will employ a novel direct-drive rotating-armature architecture and proven cryogenic cooling technology from its MRI (magnetic resonance imaging) business, resulting in an improvement in reliability of the complete machine. GE's proposed SC machine will additionally reduce the dependence on the rare earth materials prevalent in all permanent magnet machines for wind. GE believes its SC generator will increase wind generation's value to the customer and thereby increase the long-term penetration of this "green" alternative energy into the world energy market. GE's proposed SC machine aims to have twice the torque density of competing technologies (>50% improvement while maintaining cost/torque) and is the only viable technology to enable a cost-effective solution for higher power wind turbine generators for both offshore and onshore applications.

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