Comparison of 10 MW superconducting generator topologies for direct-drive wind turbines - DTU Orbit (08/11/2017)

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Large wind turbines of 10 MW or higher power levels are desirable for reducing the cost of energy of offshore wind power conversion. Conventional wind generator systems will be costly if scaled up to 10 MW due to rather large size and weight. Direct drive superconducting generators have been proposed to address the problem with generator size, because the electrical machines with superconducting windings are capable of achieving a higher torque density of an electrical machine. However, the topology to be adopted for superconducting wind generators has not yet been settled, since the high magnetic field excitation allows for lightweight non-magnetic composite materials for machine cores instead of iron. A topology would probably not be a good option for an offshore wind turbine generator if it demands a far more expensive active material cost than others, even if it has other advantages such as light weight or small iron losses. This paper is to provide a preliminary quantitative comparison of 10 MW superconducting MgB2 generator topologies from the perspective of active material. The results show that iron-cored topologies have a cheaper active material and their sizes are relatively smaller than the others.

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