New Superconducting Magnet Will Lead to Next Generation of Wind Turbine Generators

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AML Superconductivity and Magnetics, in conjunction with the U.S. Department of Energy's (DOE's) Argonne National Laboratory, recently announced that their superconducting magnet system passed a landmark reliability test, demonstrating its potential suitability for wide-scale commercial applications. This new superconducting magnet will help establish a new generation of turbine generators that are roughly half the size and weight of those currently in operation.

In 2012, DOE funded AML's design for a superconducting generator for large-scale, high-efficiency offshore wind turbines. AML worked with its partners, Emerson Electric Corporation, Creare Inc., DNV USA, and DOE's Argonne National Laboratory to develop the design for a 10-megawatt (MW) direct-drive fully superconducting generator. According to AML's Vice President of Development, Vernon Prince, the design has been thoroughly vetted and validated by DOE and is ready for a full-scale demonstration project and volume manufacturing.

Key potential advantages of the AML direct-drive generator include improved scalability, reduced weight, and coils that are free of rare-earth materials. AML's design does not require a gearbox, which may lead to improved reliability and reduced maintenance costs. Although this may also be true for contemporary, gearbox-free direct-drive generator designs, the AML generator makes a magnetic field using superconducting windings that are more powerful and compact than copper-based alternatives. They are also constructed of more readily available and lower-cost materials than permanent-magnet-based generators, which are sensitive to cost fluctuations in the volatile rare-earth magnet market. In addition, AML calculates that its generator will weigh up to 50% less than a comparable permanent-magnet rare-earth generator with a 10-MW power rating. A lower generator mass has major system benefits, including a lighter—and thus less expensive—tower, and reduced installation costs through the use of smaller cranes and offshore vessels.

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