MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1644** Type: **Poster Presentation**

Thu-Mo-Po4.06-02 [40]: Performance of multi-layer fractional-slot concentrated windings for superconducting wind turbine generators in normal and short circuit operation conditions

Thursday, 26 September 2019 08:45 (2 hours)

Superconducting generator (SCG) technology is being proposed for large direct-drive offshore wind turbines due to their compactness and light weight. However, SCGs have intrinsically large magnetic air gaps and therefore produce unacceptably high torque during a short circuit. Among possible solutions, using fractional-slot concentrated windings (FSCWs) can reduce the short circuit torque to an acceptable level. However, FSCWs produce sub- and super-harmonics in the MMF which induce excessive AC losses in the superconducting field winding. Multi-layer FSCWs can be employed to reduce or eliminate these harmonics and keep a low AC loss level. Together with the advantage of suppressing the short circuit torque, multi-layer FSCWs are worth investigating to increase the technology readiness level of superconducting wind turbine generators. This paper presents four designs of multi-layer FSCWs for a 10 MW superconducting generator and evaluates their performance in the generator's normal and short circuit operation conditions. A good balance of performance between these two conditions is required and this paper therefore compares these four designs with each other and with single-layer FSCWs.

The four multi-layer designs of FSCW all adopt the 12-slot/10-pole combination, and include:
1) Three-phase double-layer winding,
2) Dual three-phase double-layer winding,
3) Three-phase four-layer winding, and
4) Dual three-phase four-layer winding.

The performance indicators for the normal operation include levelized capital cost of energy, annual energy production, usage of superconducting wires, generator mass and AC losses in the superconducting field winding. The performance indicators for the short circuit condition include torque and field current.

Primary authors: Dr LIU, Dong (Hohai University); Dr SONG, Xiaowei

Presenter: Dr LIU, Dong (Hohai University)

Session Classification: Thu-Mo-Po4.06 - Wind, Wave, Tidal Generators II