High-Voltage wind turbine with direct in-slot cooling

Goal: To design a 15 MW wind turbine generator with around 50 kV output voltage, where direct liquid cooling is used in the stator slots

Background: With today's higher and higher power levels of wind turbines it would be beneficial if the output voltage from a wind turbine could be high enough so that the transformer used today could be removed. A problem is that this requires a very high insulation level, which so far has made the concept unfeasible. ABB has made a 50 MW motor unit, called motorformer which has an output voltage in this range, through the use of HV cables. A problem is that the losses generated in the cables generate heat which has a problem to flow out to the stator iron for further transport away. A possibility is to use direct cooling of the stator slot, which is the topic of this master thesis proposal.

Plan: Make a design of a generator 15 MW 750-1500 rpm PM-generator, using the FEM program Ansys Maxwell / MotorCAD, thought for a wind turbine. The stator winding shall be design to handle 50 kV potential difference towards the stator iron. Investigate various methods of using in-slot cooling and establish the possible current densities with and without the in-slot liquid cooling.

Number of Students: 1-2

Start time: January 2019

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