Contribution ID: **456** Type: **Contributed Oral Presentation**

A Review of Cryogenic Power Electronics Progress

Monday 10 July 2017 16:30 (15 minutes)

Cryogenic Power Electronics, or CryoPower, has been proposed as an innovation for over two decades as a means of integrating power electronics and superconducting devices, particularly magnets, motors, and generators at cryogenic temperatures close to the operational temperature of superconductors. In these systems, power electronics specifically designed to operate in the cryogenic environment are installed in cryostats and in close proximity to superconducting devices. Among the benefits of cryogenic operation of semiconductors are reduced conduction losses, increased switching times, higher power density (reduced size and weight), and reduced system-level losses. Potential applications include wind turbines, maglev, all-electric aircraft and ships, utility-scale energy storage and transmission and distribution, and power systems for advanced computers, all of which may benefit from superconductivity in one form or another. Much progress has been made recently in scaling prototypes to commercial power levels.

To make CryoPower attractive, a large number of ancillary hardware and electronic components qualified for cryogenic operation is required. Most electronic components are not qualified to operate over an extreme temperature range. Consequently, difficult choices must be made and extensive testing is required to meet the demands of even a simple circuit. In addition, testing of circuits and sub-circuits often requires several cooling cycles, which must be done in a controlled fashion. As a consequence, development is much slower and more tedious than for room temperature circuits. However, this is a necessary process because of the critical reliability demands of power networks.

MTECH will summarize its most recent progress in developing fully integrated CryoPower systems, including development of a Superconducting Magnetic Energy Storage (SMES) system.

Primary authors: Dr HENNESSY, Michael (MTECH Laboratories, LLC); Mr MUELLER, Eduard (MTECH Laboratories, LLC)

Presenter: Dr HENNESSY, Michael (MTECH Laboratories, LLC)

Session Classification: M1OrE - Focused Symposia - Propulsion IV: Power Electronics, Energy