Applied Materials, Inc.

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Abstract Title:

High-Temperature Superconducting and Solid-State Electronic Fault Current Limiter Technologies – the shift from demonstration projects to Business-as-Usual solutions

Abstract Text:

Over the past several years, Applied Materials, Inc. (Applied) has invested significant resources in the development, testing, installation and operation of Fault Current Limiter (FCL) technologies. In demonstration projects FCLs have been identified as bottleneck components in the build of Distributed Generation. The transition into a set of solutions that will be accepted by both network operation engineers and asset managers has been a crucial innovative step. This presentation shall introduce the two FCL technologies developed by Applied, fields of application and key features that form the basis for their technical and commercial viability.

The first device is a high-temperature superconductor FCL (SCFCL) suitable for applications with load currents up to 1 kA, fault current reduction up to 60% of peak and rms fault current values and voltages up to 400 kV.

The second device is a solid-state FCL (SSFCL) suitable for applications with load currents up to approximately 3 kA, a very wide range of fault current reduction up to 80% and voltages up to 66 kV.

These FCL devices have gone through rigorous Failure Modes and Effects Analysis (FMEA). They have also undergone extensive type-testing at the KEMA and DOBLE laboratories and are in service in different applications and configurations in electrical networks.

Currently, three Applied FCL devices are in operation in the electric grid. The first unit is a three-phase, 15 kV, 1,000 Amperes, 50% fault current reduction device installed in the Silicon Valley Power network in Santa Clara, California, USA for general substation protection. The second unit is a single-phase, 15 kV device installed in a neutral reactor configuration in the electric network for Central Hudson Gas & Electric in Poughkeepsie, New York, USA specifically for limiting phase-to-ground faults. The third unit is a single-phase, 22 kV device with a particularly high fault current limiting capability of up to 99.9% installed in the AusNet Services network in Victoria, Australia.

Several other projects are in negotiation.

There are several potential applications for FCL devices including a large distribution substation in which the FCL device enables the bus-ties to be closed for load balancing and reliability, a power block application in which the FCL devices enables add additional generation while reducing fault contribution to the interconnected transmission grid and simultaneously improving power quality by maintaining bus voltage during faults, and a substation that employs the FCL device to improve power quality and reliability for a critical load (major hospital) by enabling bus-tie closure and generation interconnection.