Focus: Power Transmission

We have Aninda Moitra giving insights into the new technology superconducting fault current limiter (SFCL) developed by Applied Materials. These advanced current limiters are designed to help protect the electrical grid from fault currents, and have strong relevance to a country like India.

Both private and public utilities can benefit from FCL technology

— Aninda Moitra, President, Applied Materials India

What are fault currents and why are they caused? What adverse impact could they have on an electric grid?

In an electric power system, a fault is any abnormal electric current. Power surge currents are caused by a variety of factors including lightning strikes, insulator flashover, de-capping of insulators, conductors snapping, broken earth wires, downed trees or crossed power lines. During a surge, the excessive fault current that flows through the electrical system can result in failure of one section of the system or damage expensive grid equipment. Utilities can use superconducting fault current limiters (SCFCL) to protect their grid by limiting the amount of current flowing through the system, in an effort to provide continual uninterrupted operation.

In broad terms, tell us the key points of difference between conventional current limiters (usually fuse-driven) and those made by Applied Materials.

Compared to conventional methods, SCFCLs offer an alternative, technically advanced, cost-effective solution to managing fault currents. Traditional methods often employ fault-limiting fuses to limit fault currents, but the fuse needs replacing after it blows, which is expensive. They are also only available for voltages below 35kV. Series reactors are also used but they have constant high reactive losses, are bulky, and contribute to grid voltage drops. SCFCLs overcome these limitations. In addition, rising fault current levels increase the need for larger and more costly high impedance transformers. In contrast, SCFCLs are designed to operate with little to no impedance during normal operation, for a more stable system.

What is the difference between Solid State Fault Current Limiters and Superconducting Fault Current Limiters?

Solid State FCLs use power electronic devices unlike superconductors in superconducting FCLs. Solid state FCLs are more suitable for lower power with voltages up to 45kV. Superconducting FCLs use the inherent physical properties of the superconducting material and do not rely on any external sensing. Superconducting FCLs also scale quite easily to very high voltages, even those exceeding 500kV.

Tell us about how FCLs, by virtue of offering stability to the electric grid, fit into the Smart Grid ecosystem.

A Smart Grid is also by definition a very tightly connected grid. While tightly connected grids (bus ties closed) increase fault currents, they also support the addition and transfer of power from new and alternate sources of generation. Grid stability is also increased by being more tightly connected. FCLs offer the path to enable this by keeping the fault current level low.

What are the various factors to be considered (by utilities) before deciding on an Applied Materials solid-state or
superconducting fault current limiter system?
Utilities and Applied Materials together should study the electric grid in detail before making this decision. The factors that will determine whether a solid-state or superconducting fault current limiter is the optimal solution are the system voltage; the load current; the frequency of faults; maximum fault current; and, fault current reduction required.

Tell us about the two Applied Materials SCFCL installations in the US—Santa Clara and Central Hudson.
Applied Materials SCFCL systems are currently installed in two locations in the US. One of the sites is in California and the other is at a utility in New York State. The different climates of these locations have given us the opportunity to show how our solution performs in diverse weather conditions. With regard to how our SCFCL systems are working, the unit at the New York installation is performing as intended and has successfully protected the electrical system from 15 faults so far. More information on the New York installation is available in the press release.

What are your plans of launching these FCLs in India?
In a country like India, with its growing economy and increasing demand for power, both public and private utilities may significantly benefit from FCL technology. India has made huge strides over the past decade in improving the country’s power generation capacity. To reach the full potential of making stable, reliable electricity available to everyone, the focus has to shift towards improving the transmission network.

We are working closely with several utilities in India and have developed detailed technical solutions to help solve their high-value problems. We are committed to enabling the utility markets in India improve the reliability and quality of power.

Isolux Corsan completes 765kV line for PGCIL
Isolux Corsan, India, the Indian subsidiary of the largest European infrastructure company operating in India, has announced the completion of its first high voltage transmission line EPC project for Power Grid Corporation of India Ltd. Isolux Corsan undertook the complete engineering, procurement and construction of 163.6 km of 765kV single circuit transmission line on the Pune-Solapur section in Maharashtra. This line is a crucial link to PGCIL’s National Grid. The fully-completed project is now set to unify the southern and western regions which will improve the process of distribution of electricity as and when the Krishnapatnam Ultra Mega Power Plant commences, a release from Isolux Corsan noted. The project has been completed within the stipulated timeframe despite serious operational challenges like inhospitable terrain, land acquisition and inclement weather.

Isolux Corsan is the first Spanish company specializing in building major infrastructure to win an infrastructure concession in India and is also executing two more projects from PGCIL in Karnataka, and Uttarakhand, the release added.