Applied Materials, Inc has developed a new technology superconducting fault current limiter (SFCL) designed to help protect the electrical grid from fault currents. In this exclusive interaction, we have Dr Omkaram Nalamasu giving insights into this new technology. He explains how the new SFCL scores over conventional methods and how even a country like India stands to benefit from this new technology. An interaction by Venugopal Pillai.

**SCFCL technology can help Indian utilities to boost efficiency**

— Omkaram Nalamasu (Ph.D)
Senior Vice President & Chief Technology Officer,
Applied Materials, Inc.

Tell us in some detail about the superconducting fault current limiter (SCFCL) developed by Applied Materials and the types of faults that it could protect an electric grid from.

Applied Materials used its expertise in high-voltage engineering design, power systems integration and systems engineering to develop its superconducting fault current limiter. Our SCFCL is designed to provide critical ‘Impedance on Demand’ capability only when the system needs it to reduce the fault levels. When a fault occurs, the superconducting material experiences a phase change caused by the in-rush of large current and becomes resistive, prompting the current to transition to a properly sized shunt reactor that limits the current to an acceptable value. When the system is running under nominal conditions, the load current flows through the superconducting portion of the device where it has virtually zero impedance. Therefore, under nominal conditions there is little or no voltage drop and no active or reactive power loss associated with the SCFCL.

SCFCLs have numerous applications throughout the grid. Applied’s SCFCL can be scaled to meet varying needs in generation, transmission and distribution up to 400kV and fault currents greater than 100kA. They can be installed in any location or interconnection point where the mitigation of current benefits the overall performance of the electric system.

**What could be typical causes of a sudden power surge and what detrimental impact could it have on a power grid?**

Power surges 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 by causing a circuit breaker to trip or a blown fuse. Utilities can use SCFCLs to protect their grid by limiting the amount of current flowing through the system, allowing for continual uninterrupted operation.
Where have SCFCLs by Applied been installed so far? How has the overall performance been?

Applied’s SCFCLs are currently installed in two locations in the US. One of the sites is in California, and the other, more recent placement, is at a major 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 SCFCLs are working, the unit at the New York installation is performing as intended and has protected the electrical system from six faults so far.

Please explain how SCFCLs of Applied are superior to conventional current limiting reactors.

Compared to conventional methods, SCFCLs offer a technically advanced, cost-effective solution to managing fault currents. For example, traditional methods often employ explosive fault-limiting fuses to limit fault current, but they require replacing the fuse 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 to these transformers, SCFCLs operate with little to no impedance during normal operation, which allows for a more stable system.

What is the comparison in terms of capital costs?

Overall, in terms of capital costs, Applied’s SCFCL is a cost-effective solution that is highly customizable to accommodate different budgets.

Please discuss Applied’s plans of launching its SCFCLs in India. Specifically, by when can we expect the country’s first installation?

We are currently in advanced technical discussions with several leading transmission utility companies in India. If everything goes according to schedule, we could see the first SCFCL installation in 1–2 years.

Promotion of new technology in the traditionally conservative power utilities sector can be a difficult proposition. What is your view?

Given the responsibility of the utilities to provide reliable energy to a growing populous, it’s understandable that any new technology must be carefully assessed. However, we’ve found as fault current levels increase and become a larger problem for utilities, they are open to considering advanced solutions like our SCFCL. Also appealing is the fact that a recognized technology leader like Applied Materials is the company offering SCFCL technology. Our proven track record in developing and supporting technologies that have enabled the successful growth of several industries helps to relieve concerns over adopting this new solution.

Do you feel that private utilities could be a good starting point for introducing SCFCL’s to India?

Compared to government-owned utilities, private utility participation in the transmission sector is limited. Therefore, we work with all utility companies that are seeking to solve their high fault current problem.

Does Applied’s SCFCL technology meet the needs of an entire electricity distribution system including India’s planned UHVAC (1,200kV) initiatives?

Applied’s SCFCL is usable in both distribution and transmission levels—at voltage ranges between 6.6kV and 400kV. We plan on scaling the technology to the UHVAC range as the need arises and the technology matures.

Please discuss how you would like to see the Indian power grid adopting SCFCL technology over the next 3-4 years.

India has significantly improved its power generation capacity over the past decade to fulfil its goal of providing stable and reliable electricity to the entire country. As part of this objective, the utilities have also focused on upgrading the transmission network. By effectively protecting the system against faults, SCFCL technology may be able to help Indian utilities boost the efficiency and reliability of the country’s electric transmission and distribution. We look forward to working closely with the utilities in India to install and operate our SCFCLs to support continued energy expansion and the improved performance of the Indian power ecosystem.