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New product takes active approach to limiting line sag

Transmission lines that sag under heavy use and high temperatures are the bane of transmission line operators. These lines are not only limited in the amount of power they can carry, but sagging lines run a higher risk of contacting trees and shorting out. A sagging transmission line in Ohio is believed to be the event that triggered last year's blackout.

Up until now, utilities have had two basic approaches to dealing with line sag. They could either re-engineer the line, or monitor it to assure that sag limits are not breached. Re-engineering, which typically involves raising tower heights and/or reconductoring, addresses the problem but is an expensive solution. Monitoring is a passive approach that manages the problem of sag but doesn't address the utility's need to maximize power flows.

Material Integrity Solutions has developed another approach. The company's "sagging line mitigator," or SLiM, is a device that actively compensates for line sag by shortening the span as the conductor temperature rises. "One of the advantages of this device is that it actually solves the problem rather than just monitoring it," MIS adviser Dariush Shirmohammadi said.

The unique feature of the SLiM is its use of a "shaped memory alloy." This is a material that MIS uses and trains to contract rather than expand when heated. The shaped memory alloy contained in the SLiM shrinks under high temperature. This shrinkage is multiplied by the lever design of the device, providing an effective reduction of the conductor length by about eight inches, which in turn can eliminate several feet of sag depending on the line configuration.

Shirmohammadi said that the amount of sag that can be eliminated by SLiM normally increases for longer spans. Sag reduction can also be boosted by using additional SLiM devices within the same span or even in the adjacent span depending on line configuration.

The device is installed using standard cable accessories. It requires no maintenance and is expected to have a life span equal to the conductor itself.

When series production begins, Shirmohammadi said he expects the SLiM solution to cost "about half of the cost of the least expensive alternative" currently used to address excessive sag, such as raising tower height.

SDG&E currently testing SLiM

SLiM performance was demonstrated at a Pacific Gas and Electric test facility in 2002 and its reliability was confirmed by tests conducted by Toronto firm Kinectrics Inc. in January 2004. Last May, San Diego Gas & Electric installed a pre-production SLiM device on a 400-foot span of 69-kV line between two substations in the Escondido area for trial.

"We feel [SLiM] holds great promise for giving us the opportunity to increase the amount of power we can move over the lines without the environmental or visual impact of reconductoring or putting in new poles," SDG&E spokeswoman Stephanie Donovan said. The SLiM device could also be a very cost-effective solution that "benefits not only us but our customers as well," she added.

MIS is currently securing the funding and manufacturing facilities to begin manufacturing SLiM devices in commercial quantities. Shirmohammadi said MIS expects to announce the launch of a separate company to manufacture and market the device at Electric Power Research Institute's Aug. 18-20 *Increased Power Flow* conference in Boston.

External funding for SLiM development and demonstration has been provided by the California Energy Commission as well as through EPRI under a tailored collaboration initiative in which BC Hydro, Consolidated Edison, PG&E, SDG&E, Southern California Edison, Public Service of New Mexico, Northeast Utilities and National Grid participate.

MIS has already started marketing the SLiM device, and it has attracted considerable interest worldwide, Shirmohammadi said. "We want to launch in the U.S. first," he said, "but we have other utilities overseas who cannot wait to get their hands on this." SM

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