



AEP's Bixby substation in Groveport, Ohio

## Columbus Superconducting Power Project Reaching Toward Third Anniversary

In 2006, American Electric Power (AEP) teamed up with Southwire Company and nkt cables of Denmark to demonstrate the viability of the newly created HTS Triax<sup>®</sup> cable design in its Bixby substation in the Columbus, Ohio suburb of Groveport. The HTS Triax cable provided the link from a 138 kV - 13 kV step-down transformer to a 13 kV substation bus an eighth of a mile away when it was energized in August 2006.

HTS Triax cables cooled by liquid nitrogen have become commercial solutions to the challenge of adding power to densely populated areas. Operating at 13 kV, the HTS Triax system uses a single compact cable to carry 3,000 A. That provides the equivalent of 18 conventional underground cables with no new duct construction.

### PROJECT OVERVIEW

PROJECT: Columbus HTS Triax Project

LOCATION: Columbus, Ohio

PROJECT OWNER: American Electric Power (AEP)

PRODUCT USED: HTS Triax Superconducting Cable

IN-SERVICE DATE: August 2006

“HTS Triax systems are now commercial technology in the cost-reduction stage.”

# Exciting New Technology Proves To Be Very Reliable



HTS Triax Superconducting Cable termination at AEP's Bixby Substation in Groveport, Ohio.

Back in 2006, people saw HTS equipment as exotic technology. But the HTS Triax system does what good technology is supposed to do: It just quietly works. The drama level is equivalent to watching paint dry.

The Columbus HTS Triax system is now in its third year of operation. People viewing the system today are considering HTS Triax facilities in their own cities. They want high current-density distribution with the reliability of a well-designed anvil. HTS Triax systems are on their short lists.

## “High-temperature” is relative

“High-temperature” superconductivity (HTS) is relative: HTS conductors run in liquid nitrogen at  $-320^{\circ}\text{F}$  ( $-196^{\circ}\text{C}$ ). Transmitting current with almost no resistance, HTS puts high-density, low-loss capacity in existing duct banks. That’s a key to cost-effectiveness in urban settings.

## Urban areas benefit from HTS Triax

Because HTS Triax cables carry very high currents at distribution voltages in existing ducts, large power transformers can be pushed out to less-crowded areas of a city. That lets urban planners free up valuable real estate for development or green space. HTS Triax technology also allows increased interconnectivity among urban substations.

## HTS Triax performs worry-free

The combined operational time of the three longest-running commercial-scale Southwire and nkt cable HTS projects adds up to over 11 years of consistently reliable power delivery. HTS is now commercial technology in the cost-reduction stage. For example, Columbus uses innovative pulse-tube cryogenic cooling technology that

allows fewer parts, lower cost, smaller footprint, less maintenance, and more energy-efficiency than older systems.

The Columbus HTS Triax system carries the full 13 kV station load, and it has been pushed hard: It saw 2,715 amps per phase during peak summer months, over 90 percent of its design rating. It has weathered lightning and snow and ice, and ambient temperatures ranging from  $0^{\circ}\text{F}$  to near  $100^{\circ}\text{F}$ . Fault events coming in from the grid have driven currents up to 17,700 A per phase for 222 milliseconds, with a repeated 17 kA fault peak six seconds later. The system has never been out of service due to one of these events.

## Decreasing costs encourage commercial adoption

Southwire has been pioneering HTS projects since the late 1990s. Southwire’s ability to adopt cost-reducing add-ons such as pulse-tube cooling makes Southwire HTS Triax systems even more attractive to budget-bound city planners struggling to add power to urban centers.

“Engineering advances are continuing to cut HTS Triax distribution costs,” says David Lindsay, Director, Distribution Engineering for Southwire. “The long-term cost-effectiveness of the Columbus HTS Triax project has supported decisions to proceed with HTS Triax systems in Manhattan and New Orleans.”

## Partners Developed Columbus Project

The Columbus HTS Triax installation was developed by Southwire Company and its partners, American Electric Power, Praxair, American Superconductor and the U.S. Department of Energy’s Oak Ridge National Laboratory.

