Project Fact Sheet

Long Island HTS Power Cable

HTS cable at the LIPA substation.

This project involves the demonstration of a high-temperature superconducting (HTS) power cable in the Long Island Power grid, spanning nearly half a mile and serving as a permanent link in the Long Island Power Authority's (LIPA) grid network. The cable represents the world's first installation of a superconducting cable in a live grid at transmission voltages.

What are its Primary Applications?

HTS power cables are used for electric transmission and distribution. The Long Island cable carries electricity at transmission voltage, which is how power is delivered over long distances.

What are the Benefits to Utilities?

Investment in electrical transmission and distribution infrastructure gained importance in the wake of the August 2003 blackout in the northeast. It became apparent during the blackout, and during the investigations that followed, that new technologies are required to relieve constraints on the grid, particularly in the most populated and power-hungry areas of the nation.

Rapidly growing demand constantly challenges utilities to find new ways to conduct electricity to where it is needed, safely and reliably.

Siting new transmission lines has become a formidable challenge to utilities in congested areas such as Long Island. HTS cable can carry several times more current than a conventional copper cable with the same diameter. HTS cables can be installed in existing rights-of-way, helping to reduce the cost and environmental impact of grid upgrades.

What is the Market Potential?

The Edison Electric Institute estimates that the U.S. transmission grid requires an investment of $56 billion over 10 years to meet new demands and maintain reliability. Much of that amount will go towards expanding the capabilities of power transmission.

As energy demands and environmental concerns increase, underground HTS cable will provide the necessary alternative to meet power supply needs. The development of commercially viable HTS transmission cable will allow U.S. industry to capture a large portion of the growing national market. In addition, international markets are estimated to be 10 times larger than the U.S. market, and those markets are growing more rapidly.

Superconducting cables have the potential to create an efficient "electricity superhighway," much like the advent of fiber optic cable has aided the development of the "information superhighway."

What are the Project Accomplishments to Date?

American Superconductor has built the world's first commercial-volume HTS wire manufacturing plant in Devens, Massachusetts, and wire for the HTS cable has been manufactured at the new facility. The project team has developed the components of the cable system, and prototype testing was completed to validate the develop-

What is the Status of the Project?

The cable was energized April 22, 2008 and serves the equivalent of 300,000 homes. It is the first HTS power cable to operate at transmission voltage in the grid. LIPA plans to retain the superconductor as a permanent part of it's grid.

Goal:
To demonstrate a 2,000-foot-long HTS power transmission cable operating at 138 kilovolts in the Long Island Power Grid, the first ever installation of a superconductor cable in a live grid and at transmission voltages.

Team:
American Superconductor (HTS Wire Supplier and Project Lead)

Nexans (Cable Manufacturing)

Air Liquide (Refrigeration System)

Long Island Power Authority (Host Utility)

Period of Performance:
3/2003 – 9/2008

Cumulative Project Funding:
Private $23.45 million (50%)
DOE $23.45 million (50%)
Total: $46.90 million

What is it?
A power cable is designed to carry large amounts of electrical current over short or long distances.

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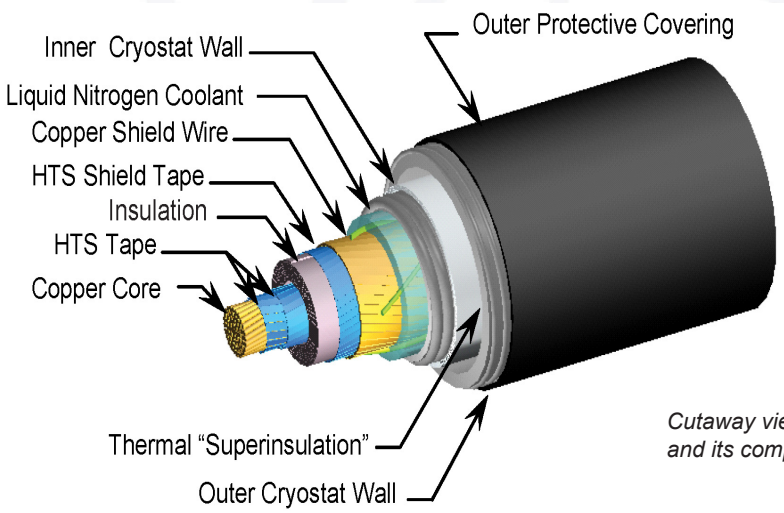

Cutaway view of the LIPA cable and its components.

ment results. The wire to fabricate the cable was manufactured and shipped to Nexans, where the cable was assembled. It was then returned to Long Island for installation.

The cable has been installed in an existing right-of-way in Lake Ronkonkoma, NY. The 138-kilovolt cable is capable of delivering power to 300,000 homes and is an integral part of the LIPA grid. The cable was energized April 22, 2008.

After an initial operational period followed by performance and economic reviews of the cable system, LIPA plans to retain the new superconductor cable as a permanent part of its grid. LIPA and American Superconductor are also formulating plans to install high-capacity, low-environmental-impact HTS cables elsewhere in the LIPA grid to address the growing electric power needs on Long Island.

Alignment with Administration Priorities:
National Energy Policy: " … expand the Department's research and development on transmission reliability and superconductivity."

National Transmission Grid Study: " … accelerate development and demonstration of its technologies, including high-temperature superconductivity…"

Energy Information Administration: "Of [advanced power delivery] technologies, superconductivity holds the most promise for yielding significant efficiency gains."

How Does it Work?
HTS wires today can conduct more than 150 times the power of copper or aluminum wires of the same dimensions. This enables cables made from HTS wires to carry more power in existing rights-of-way than conventional cables or overhead lines. Also, conventional wires made from copper or aluminum conductors have resistance, and some of the electric power is lost as the resistance impedes the flow of current while passing through the cables. The current in the Long Island cable is carried through HTS wires, which exhibit zero resistance when cooled to about -321°F with liquid nitrogen. In the cooling system, liquid nitrogen is circulated within a thermal envelope (cryostat) to cool the superconducting tapes (wires) through which electricity flows. The superconducting tapes, which are wrapped around the core of the cable, make up the phase conductor, replacing the copper or aluminum in conventional cables.