

Powerline Conductor Operational Testing Facility (PCOT)

Overview:

The Powerline Conductor Operational Testing Facility (PCOT), currently planned for construction in Oak Ridge, Tennessee, places advanced overhead power line conductors and superconducting cables into an operational high-voltage (HV) transmission system for long-term testing and evaluation. The HV transmission test network within PCOT will be operated jointly by TVA and ORNL and is within DOE's K-25 federal facility. PCOT provides a controlled environment where the conductors/cables are operated in various loading modes, heavily instrumented, and accessible for joint government and industry (i.e., conductor manufacturers, utilities) testing. Furthermore, the unique power switching arrangement available at PCOT allows for the loading of the conductors/cables under test at the transmission system operator's discretion. Loading can be controlled at the Roane, Tennessee, 500-kV Substation. In addition to testing advanced conductors and cables, PCOT provides a facility for realistic field testing of advanced sensors and communications that have been successfully developed using the indoor and outdoor PCAT facilities or by industry and tested at these facilities.

Description:

The TVA transmission network on the DOE Oak Ridge reservation provides a unique opportunity to develop a Powerline Conductor Operational Testing (PCOT) Facility. PCOT will place advanced conductors under test into operational transmission lines at 161-kV, in a controlled environment where their operating modes (i.e., loading, operating temperature, sag) can be varied. The installation is heavily instrumented and public access is not a barrier. Further, the unique switching arrangement available at PCOT, as shown in Figure 1, will allow for the conductor under test to be loaded at the transmission system operator's discretion. Loading status can be adjusted through operational adjustments at the TVA's Roane 500-kV Substation. The line flow on the test conductor can be varied or removed within several minutes through SCADA. The PCOT provides the contingency for the test conductor to be switched completely out of service and for its loading to be picked up by conventional conductor if the transmission system operator feels that the power system security is at risk. The operational flexibility of PCOT allows advanced conductors under test to be subjected to greater and more controlled stress, at full voltage and current, than is currently possible anywhere else in the nation.

PCOT will also provide a testing environment for advanced sensors and communications. Sensors successfully developed and tested by industry or by the Indoor PCAT and Outdoor PCAT facilities can be tested at high voltage and under more realistic transmission system operating conditions. PCOT provides a testing environment and an ability to subject the sensor to a broader range and more severe operating conditions in an accelerated time frame than what would be experienced on a conventional power system. The extensive instrumentation that PCOT will employ provides the necessary verification that the new sensor is delivering accurate information and further, possible problems and improvements can be identified. PCOT's location on a DOE federal reservation will protect both the sensor and its associated test equipment from direct public exposure and facilitate regular access by development and testing

personnel both from government and industry while at the same time providing a controlled environment for visitors.

PCOT Test Site:

The PCOT test site is located between the TVA Kingston Power Plant, a 9-unit, 1400 MW coal-fired generating power station and switchyard, which is 10 miles to the West, and the TVA Roane 500/161 kV Substation, which is 1.5 miles to the East. At the PCOT site, a double-circuit transmission line operates at 161 kV on one side and the other side, which is deenergized, will be used for operating the advanced conductor under test. The length of the test line is 2 mile with four double-circuit towers and 3 spans. The transmission towers are steel lattice with a vertical phase-over-phase conductor arrangement. The span lengths are 591.2, 1100, and 901 ft. The elevation change over the 2 mile distance is 164.26 ft. The maximum line flows that could be obtained on the test line range from 650 to 1000 A, depending upon the season of the year.

For testing high-temperature superconducting cables, the site offers a variety of installation and operating options including above ground, buried, elevation changes, tunneling and water crossings.

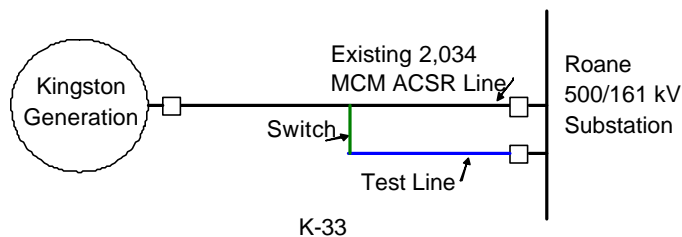


Figure 1. A unique arrangement of transmission facilities at PCOT provides at-voltage and at-current transmission conductor testing flexibility.

Initial studies to determine what modifications are needed to the TVA transmission system to maximize the testing capability of PCOT have been conducted. Development of PCOT will take place in the early part of FY2004 with conductor tests commencing in the later part of FY2004.

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