Abstract

The economic integration of remotely located, yet attractive sources of energy (e.g., renewables) into large electric power systems depends on achieving secure and reliable transmission of electric power at the gigawatt level. Improved electric power transmission efficiency is a growing concern as well. Because of these and other emerging "realities" we may expect the future electric power system to be quite different from today – one that is characterized by wide-scale deployment of technologies considered "novel" today. Issues that will drive the selection of these new technologies include: efficiency, reliability, and security. Superconducting power system technologies are attractive in general because they answer to all of these issues. Superconducting dc power cables are inherently more efficient than equivalent resistive technologies. They will be easier to site because they require less land (a smaller corridor) than do overhead power lines, which face considerable resistance from environmental advocates. And, because the superconducting dc cables will be underground, they will be more secure and more reliable than conventional transmission lines. Reliability can be enhanced by using two full-capacity cables that can share the load or can operate independently at full power.

Responding to the anticipated changing technology needs of a Twenty-first Century electric grid, in 2005 EPRI began a four-year project to investigate the possible design, function and potential applications of a high-temperature superconductor-based dc cable of the future. A primary goal was to produce a conceptual design with sufficient engineering content that it could be built with present-day engineering capabilities. Improvements in the performance of superconductors over the next two decades were the only exception to this "present-day" design philosophy. The results of this project, including details of the design and the procedure for choosing various parameters for the cable system, were published in three, publically available reports. This presentation provides an overview of the EPRI project, introduces additional findings subsequent to the project completion, and briefly presents one novel application of a multi-gigawatt superconducting dc cable.