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Southern California Edison's Smart Neighborhood Distribution Circuit

Southern California Edison (SCE) announced in October 2007 it had designed and installed the nation's most advanced neighborhood electricity circuit. SCE's "Circuit of the Future" now delivers power to 1,400 residential and business customers in Southern California's Inland Empire, the nation's fastest growing urban region. SCE smart grid engineers built five ground-breaking technologies into the circuit that promise to give customers surer electricity service, fewer outages with faster service restoration and lower future costs than would otherwise occur.

History

SCE's Circuit of the Future project began in late 2003. The goal was to develop a test platform for incorporating new technologies and methods that increase reliability and safety while controlling customer costs. SCE engineers saw a need to increase circuit performance, reduce life cycle costs and incorporate new technologies as they become available. The project began with a review of new technologies and current distribution circuit designs.

In March 2004, an internal competition was held with representatives from SCE, Department of Energy, Oak Ridge National Labs, Electric Power Research Institute, California Energy Commission, and KEMA Consulting participating as judges. The winning design formed the basis for the circuit, which became operational in August 2007. The 12-kilovolt circuit, named Avanti, originates in SCE's Shandin Substation and provides power to 1,420 residential and business customers.

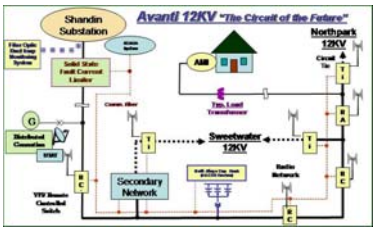
Circuit of the Future Design

The circuit design is flexible enough to test a variety of equipment types, communication strategies and protection schemes. Technologies envisioned in Avanti's design include the following:

- advanced sensors
- vacuum fault interrupters
- duct temperature monitoring
- advanced capacitor switching devices
- advanced communication technologies
- provision to distributed energy resources
- automated reclosers
- fault current limiters
- modular hybrid poles

Advanced Circuit Features

• A pad and bypass disconnect switch has been added to Shandin Substation for demonstrating various fault current limiters as part of a California Energy Commission initiative.
• The circuit has an interconnection site for SCE's portable, skid-mounted distributed energy resources and future storage technologies.
• Radio frequency identification tags will be used to provide immediate access to structure information, including the maintenance and operating history.
• The circuit utilizes fiber optic connections for critical communication nodes to ensure high speed, reliable data communication between the various pieces of equipment and a master control center. This isolates the equipment testing from the communications testing.
• Broadband-over-power line and other technologies also are being investigated for use in transmitting data, dispatching control commands and sending demand response signals.



Advanced Automation Schemes

Current automation schemes can take up to 70 seconds to locate and isolate a faulted line section. As part of a U.S. Department of Energy research and development project, SCE is performing laboratory testing that involves a logic processor, working in combination with vacuum fault interrupters and automatic reclosers, to locate and isolate faulted sections. This operation is expected to execute so quickly the substation breaker would not have to trip. Such an automation scheme would drastically reduce the duration and potentially the frequency of faults on the distribution feeder.

Thermal Duct Management

Fiber optic temperature monitoring is expected to improve the safe operation of the main line cable from substations to circuits. As part of this project, fiber optic strands will be placed in duct banks to measure cable temperatures. Dynamic thermal rating of the cable ducts should safely optimize the power throughout in underground cable distribution systems.

What a Smarter Grid Means for Customers

• Enhanced utility service reliability.
• More stable, higher-quality electricity supply.
• Shorter customer outages, faster service restoration.
• A "self-healing" grid.
• New customer program and service options.
• Increased customer control of energy costs.
• Customer connectivity to new "communicating" appliances.

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