

CONDUCTOR BURNDOWNS AND WILDFIRE MITIGATION WHEN USING COMPACT SINGLE-PHASE RECLOSERS



Example of a compact single phase recloser protecting a tap off the end of a three-phase line.

PROJECT HIGHLIGHTS

- Reduce energized, downed conductors
- Reduce wildfire risks
- Better apply compact single-phase reclosers
- Understand impacts of new technologies on aged infrastructure

Background, Objectives, and New Learnings

Electric companies are in the process of deploying a new class of compact single-phase reclosers (for example, S&C TripSaver or Siemens Fusesaver) to improve reliability and reduce momentary outages. Utilities have reported a number of energized downed conductors past these compact single-phase reclosers. Reclosers on downstream taps create challenges including:

- **Downed conductors from burndown and mechanical damage:** Application of these reclosers to aged and smaller diameter conductor may increase the likelihood of electrical burndowns and conductors broken from mechanical damage. Reclosing on a downed conductor creates a significant public safety hazard.
- **Wildfire ignition:** Energized downed conductors ignite ground vegetation. In times of high wildfire risk and during extreme wind events, many utilities choose to block reclosing. That may or may not be possible with commercially available compact single-phase reclosers, so there is a need to manage these risks.

Stresses that can lead to conductor failure and downed conductors include burndowns from arcing faults, burndowns from intermittent arcing caused by tree-limb contacts, upstream failures during a high-current fault due to equipment failures or conductor slap, and mechanical damage. All of these are a function of conductor size, type, and the speed of protective devices. The use of reclosing may affect the probability of these failures. Aged infrastructure may also increase risks.

The purpose of this project is to understand the impacts of using single-phase reclosers on downstream taps and its implications for downed conductors and wildfire ignitions.

Benefits

Public benefits from this project include increased reliability and safety by reducing the likelihood of energized downed conductors and wildfire ignitions. Funder benefits include an increased understanding of the impact on conductor burndown when using compact single-phase reclosers and how to reduce the likelihood of wildfire ignitions due to reclosing attempts.

Project Approach and Summary

EPRI plans to perform testing and analysis of compact, single-phase reclosers at EPRI's Lenox Laboratory to help inform utility applications.

1. **Recloser performance:** Assess the capabilities of commercially available single-phase reclosers. Key device parameters may include minimum recloser operation time, ability to perform single-phase trip and three-phase lockout, and protection settings options. Evaluation of field data related to downed conductors past these devices may also be performed.
2. **Electrical conductor burndown characteristics:** Perform high-current lab testing to evaluate burndown characteristics of different conductors and recloser settings and the likelihood of burndowns. Conductors are expected to be prioritized by members. Options can include copper, aluminum, aluminum alloy, and covered conductors. Evaluation of aged conductors can also be considered. Testing can be done with protection from single-phase reclosers in single-phase and line-to-line fault scenarios. Adjustments can be made to evaluate different recloser protection options.
3. **Vegetation-caused burndowns prior to flashover:** Lab testing has identified an unexpected mode of failure—small, bare conductors may burn down before a fault occurs. Intermittent arcing to a tree branch prior to a low-impedance fault forming was enough to burn down conductors. Tests of limb contacts will better identify the likelihood based on different constructions. Evaluation of aged conductors can also be considered.
4. **Wildfire ignition:** Identify preferred settings and capabilities for compact reclosers in times of higher likelihood of wildfire and other extreme weather. Evaluations can include communications and adaptable settings to block reclosing when needed.
5. **Application guidance:** Provide guidance for selection and application of compact single-phase reclosers. The project aims to assist in the development of leading protection practices for this new application.

Optional task – Custom evaluation: Conduct burndown performance testing of the utility's chosen device, device settings, construction design, and conductor size/type. This task includes one day of high-current laboratory testing with the utility helping to direct scenarios.

Deliverables

All participating utilities will receive regular update webcasts, the results of each task in a final report, and an end of project workshop. The non-proprietary results of this work will be incorporated into EPRI's Distribution Systems R&D program, and available to the public for purchase, or otherwise.

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Price of Project

The price to participate is based on participant's annual distribution throughput (GWh):

- \$85,000 for companies with distribution throughput greater than 30,000 GWh
- \$65,000 for all others

The optional task is \$40,000 for each additional day of high current lab testing. Ten participants are needed to complete the full scope of the project. This project qualifies for Self-Directed Funding (SDF). The project can be funded over two years.

Project Status and Schedule

The project is planned to occur over an 18-month period and will commence when six participants have joined.

Who Should Join

Utilities that are considering adopting or have adopted compact single phase reclosers. Also, utilities that are concerned about burndown of aged conductors and those who are trying to mitigate issues.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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