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Alternative Technologies for Recloser Backup Power

Project Highlights:

- Document current utility practices and requirements for backup power systems
- Identify recloser battery monitoring and maintenance approaches
- Investigate new energy storage technologies that may deliver better performance
- Reduce recloser O&M costs and increase reliability with regard to the control backup power system

Background, Objectives, and New Learnings

Many utilities have recently completed, or are in the process of, wide-scale deployment of distribution reclosers as part of grid modernization efforts. In concert with deployments, utilities are also developing plans of how to maintain them. Experience has shown that battery maintenance represents the largest O&M expense related to recloser management. As such, these expanded deployments may increase O&M spending related to battery maintenance.

Traditionally, batteries were replaced on a periodic cycle during regular inspections. Today, most utilities rely on a battery test that generates an alarm from the recloser control that indicates that the battery may not be able to perform its function. Based on this alarm, a technician is sent to replace the battery. In some controls, this alarm may give advance warning of more than a month prior to battery end-of-life. Other systems only send an alarm after the battery has reached end-of-life, resulting in a recloser that may not operate effectively until the battery is replaced.

The backup batteries in most controls are valve regulated lead acid batteries (VRLA). This energy storage technology has been the standard for many years, however there are several new energy storage technologies that may prove useful.

The objective of this project is to investigate the suitability of alternative energy storage technologies to provide recloser backup power.

Benefits

Utilities may benefit from this research by reducing O&M expenses through more cost-effective maintenance for control backup power systems and by reducing the number of battery replacements. The public may benefit through enhanced reliability and wider scale deployments of reliability-enhancing technologies.

Project Approach and Summary

This project will consider several areas related to backup power systems in distribution recloser controls.

Task 1: Document Current Backup Power Practices

This task aims to document utility approaches for recloser backup power and how power is provided to controls. There is a wide variance within the industry depending on whether operators control through SCADA or through a fully automated restoration system. The task will also document the functional requirements each participant utility is using for backup power for different modes of device operation (centralized or decentralized automated restoration, operator-controlled restoration, etc.). Backup power requirements may include charging/discharging characteristics, required backup time, ability to support any required load, total required energy for operation, and environmental considerations.

Task 2: Explore Battery Alternatives

Utilizing the functional requirements from Task 1, this task intends to explore alternatives to VRLA batteries and identify

options that could deliver the same or better functionality, while also extending the time between battery changeouts.

Task 3: Evaluate Battery Alternatives

This task intends to perform laboratory testing of suitable energy storage alternatives. The testing will evaluate the compatibility of new energy storage technologies with recloser controls without degrading asset performance. This task may also define new functional requirements for backup power systems in controls and develop guidance for retrofit applications.

Task 4: Environmental Effects on Battery Life

This task plans to investigate how environmental conditions impact performance of VRLA alternatives. Extreme temperatures have been shown to lead to a reduction in battery life. VRLA batteries used in recloser controls see a reduction of battery life by one half for every 8°C rise in temperature above 25°C. The outcomes from this task are expected to inform specification and deployment of alternatives.

Task 5: Battery Health Monitoring

This task intends to investigate current battery testing approaches and demonstrate in the laboratory new techniques to monitor battery state of health. The task will also consider how new energy storage technologies may require a redesign of the battery test function.

Optional Task: Long-Term Monitoring

EPRI will work with interested utilities to conduct field demonstrations to understand how these new battery technologies perform in the field.

Deliverables

The deliverable from this research is a report documenting the results from the project along with research updates as the project progresses.

The non-proprietary results of this work will be incorporated into EPRI Distribution Systems R&D program and will be made available to the public, for purchase or otherwise.

Price of Project

The cost is $30,000 per participant. The cost of the optional task is $15,000. Seven utility participants are needed to execute the full scope of the project.

This project qualifies for Self-Directed Funding (SDF) or Tailored Collaboration (TC) funds. The project can be funded over three years.

Project Status and Schedule

This project is expected to run for 24 months with periodic meetings to share results throughout the life of the project. The project is expected to begin in late 2020.

Who Should Join

Members who have or are in the process of widescale recloser deployments should consider joining this project to help make informed decisions regarding battery maintenance and potential new energy storage technologies to extend the time between changeouts.

Contact Information

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

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