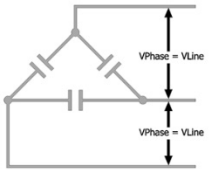
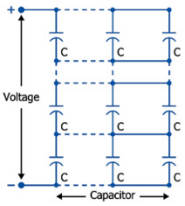
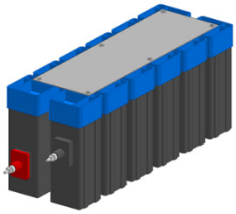
Capacitor-Based Energy-Saving Devices







- Evaluation of capacitor-based energy-saving devices (CB/ESDs) in a laboratory and field environment to understand potential benefits to both the utility and the end-use customer.
- Help clarify CB/ESD performance.
- Use resulting robust evaluation criteria to vet CB/ESD products for potential customer programs.
- Determine Economic Viability of CB/ESDs.

Background, Objectives, and New Learnings

For decades, electric utilities have used AC capacitors to provide reactive power (VAr) support, boost voltage, and correct power factor (PF) along their distribution lines. More recently, they have integrated higher power density, DC-based ultra- or supercapacitors into various power electronic systems for system improvements, voltage sag ride-through, and energy savings. On the customer side of the meter, do the benefits of AC and DC capacitor-based energy-saving devices (CB/ESDs) warrant creating customer programs and incentives that use CB/ESD retrofits to lower reactive load and forestall line upgrades due to future load increases? Can customer equipment such as elevators and production lines benefit from DC capacitor energy storage to lower energy costs? To answer this question, this project seeks to evaluate a series of CB/ESDs to highlight their potential benefits for utilities and end-use customers.

Benefits

Presently, utilities and their customers have limited information about the potential benefits of CB/ESDs, even after installation. Gathering information by measuring and verifying performance results can prove challenging due to seasonal (daily to annual) changes in weather patterns. This research seeks to provide data and new learning to help utilities make an informed cost/benefit analysis of CB/ESDs. Better information could enable the creation of customer programs that save energy for customers, as well as provide grid benefits. Ultimately this could reduce costs for utilities and customers, as well as provide more program choices for customers.

Project Approach and Summary

EPRI plans to conduct a laboratory and field assessment of CB/ESD technologies using the protocol provided by IEEE 1889-2018 (Guide for Evaluating and Testing the Electrical Performance of Energy Saving Devices.) testing a minimum of two CB/ESDs. Additional sponsors may enable characterization of more technologies.

The project has two participation levels. Collaborator participant will receive quarterly updates on project progress and report results from laboratory testing of the various technologies, as well the final report. Host participants may, in addition, have EPRI conduct a field test of specific CB/ESD technologies in their territory and receive test reports and webcasts related to their specific test results.

The full approach is described below.

Conduct an updated survey of candidate CB/ESDs and develop a short list of technologies to be evaluated. EPRI will work with utility sponsors to characterize the CB/ESD products currently offered by vendors, quantify them by basic technology type where possible, and produce a prioritized list based on the desire to test an many different technologies as funding allows.

Use the protocol in IEEE Standard 1889 to test the selected devices. EPRI will use the existing ESD testing protocol in IEEE Standard 1889 so each device is tested with different load types in order to illustrate how that device impacts load and upstream power requirements. Using this protocol, EPRI will identify products capable of providing additional line capacity and/or energy savings at the customer level and point of application, identify benefit/actual value for residential and industrial customers at the point of application, and identify/categorize specific designs and constraints—with respect to customer PF correction goals—at the utility and customer level. Through these efforts, EPRI plans to develop more robust evaluation criteria for vetting CB/ESD products and to employ this knowledge as part of a larger program aimed at applying customer-sited CB/ESD correction solutions using kVA and kW billing and related tariffs, along with the value of deferral (such as new substation cost vs customer CB/ESD).

Conduct CB/ESD laboratory testing. In the laboratory, EPRI will conduct repeated tests of each selected CB/ESD and document the results for the various load types. Where applicable, a device manufacturer may be consulted to confirm that the test results are in line with those expected from a properly operational product.

Conduct CB/ESD field testing/documentation (Host participants only). Where feasible, EPRI intends to work with Host utilities and CB/ESD vendors to document performance in field test environments. Each Host-Collaborator will choose one host site, where CB/ESD equipment cost and installation will be the responsibility of the vendor or the host site. At each host site, EPRI will provide instrumentation to document CB/ESD performance and apply multivariate regression statistics to analyze collected data.

Deliverables

- An EPRI final report that details the full results of each technology assessment and provides guidance on how to assess each technology type in terms of a cost/payback analysis.
- A public version of the final report with customer and vendor data anonymized.
- Quarterly update webcasts on project progress and report results from laboratory testing of the various technologies.
- Site-specific reports and webcasts for Host members.
- An article submitted to a peer reviewed journal for potential publication.

Price of Project

The project cost is $60k per sponsor for Collaborator participants and $100k for Host participants. The project may be funded via SDF, co-funding, or both. The sponsorship may also be split over two calendar years if desired.

Project Status and Schedule

The project is slated to start in 2021 and last for two years. A minimum number of two sponsors is needed to start the project and to evaluate up to two CB/ESDs. Three sponsors are needed to do in-depth work on up to three technologies. Additional sponsors may enable additional characterization of more CB/ESDs.

Who Should Join

Utilities interested in understanding the potential end-customer and grid benefits of CB-ESDs, as well as those considering customer programs involving these devices.

Contact Information

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

Technical Contact

Mark Stephens at 865.773.3631 (mstephens@epri.com)

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EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com