Centralized Dynamic Reactive Power Support for High DER Feeders

Project Highlights:

- Provide insight into the applicability and performance expectation of D-STATCOM technology
- Conduct modeling to evaluate the applicability of the technology for specific applications
- Assess and devise test plan for selected technology pilot projects

Background, Objectives, and New Learnings

Utilities are responsible for maintaining proper distribution feeder voltage on their systems. As third-party distributed energy resources (DER) are interconnected this can become increasingly challenging. A potential solution is to apply custom autonomous DER grid support functions to these systems for voltage control., as outlined in IEEE 1547-2018. However, this solution may require multiple studies, be challenging to administer, and represent a possible operational risk. For feeders with high DER penetrations, using utility-controlled assets that are integrated into the distribution management system may offer a better solution and provide both operational and planning flexibility. Some vendors offer mature dynamic var products that can be integrated into the utility system and offer significant flexibility to manage system voltage.

One such technology is the distribution static synchronous compensator (D-STATCOM). The D-STATCOM provides continuous regulation of feeder voltage on a per-phase level through shunt reactive power compensation. The technology is suitable to reduce voltage imbalance, actively regulate system voltage with minimal transients, and provide power factor correction in a much finer resolution when compared to traditional switchable capacitor banks. Since it is a power electronics-based technology, it also provides sub-cycle response times and can address fast voltage variation problems associated with flicker and rapid voltage change. With proper siting and settings, these dynamic var products can effectively improve system voltage quality, reduce wear and tear of conventional voltage regulating devices, and provide system flexibility for future DER applications that require more active participation in grid services (e.g., frequency regulation).

The objective of this project is to: (1) assess the applicability and performance expectation of D-STATCOM technology as a centralized dynamic var support solution and (2) assist utilities in making informed decisions on employing this technology to meet their system specific needs.

Benefits

Expected benefits of this project/technology include:

- Reduced dependency on DER to regulate feeder voltage
- Support increased renewable integration through better voltage management
- Increased system flexibility to address voltage-related issues associated with DER

Project Approach

EPRI proposes to conduct the project in the following two phases:

Phase 1

Phase 1 of this project plans to conduct general analytical studies to evaluate the D-STATCOM technology, define performance requirements, and assess the economics. Typical applications and use cases will be identified and summarized

based on the inputs received from project participants. For each selected application, EPRI plans to perform analytical studies to define performance metrics and specification requirements. Preferred location and control setting selection for the technology will be shared with participating members. EPRI also plans to develop an effective methodology for a techno-economic analysis of the technology in comparison to traditional system upgrades and application of DER settings.

In addition, EPRI plans to conduct modeling studies to evaluate the applicability of the technology for specific participating utility distribution feeder (up to two feeders) applications. EPRI will obtain feeder models in commercial planning software (e.g., CYME, Synergi) and prepare the models to support steady-state and dynamic simulation studies. Simulations will be performed to assess the viability of the technology for the specific applications, and if necessary, define suitable placement and control settings.

Phase 2

In Phase 2, EPRI plans to provide a technical performance assessment for utilities doing pilot projects with the technology. EPRI will assist with the development of the test plan and data acquisition requirements, analyze the measurement data from commissioning / field tests, update the simulation model to match the test results, and deliver a performance assessment report.

Deliverables

- Periodic webcasts to update participants on project status and findings
- Technical report documenting the analytical study result in Phase 1
- Models of the custom specific feeders and applications, and simulation results in Phase 1
- Performance assessment report of each individual piloting project in Phase 2

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

Price of the Project

The cost for Phase 1 is $68,000/utility and Phase 2 is an additional $50,000/utility.

A minimum of five (5) participating member utilities will be required to initiate this supplemental project.

This project qualifies for Self-Directed (SDF) or Tailored Collaboration (TC) funds. Funding can be split across two years.

Project Schedule

The project is expected to start when the minimum number of participants is achieved and take approximately 24 months.

Who Should Join?

Utilities that are interested in understanding the capability of centralized dynamic var support solutions for addressing voltage related issues associated with DER integration.

Contact Information

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

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Product ID: 3002026474 Project ID: 1-117961 April 2023

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