

AT A GLANCE

HVDC Converter Stations and Flexible Alternating Current Transmission System (FACTS) Devices

Program 37.116

Research Value

- Provide state-of-the-art information on HVDC and FACTS technologies.
- Provide HVDC knowledge transfer to members through the HVDC Reference Book (Olive Book) and the associated courses.
- Assist members in selecting proper options for renewables integration, increased capacity, and other applications.
- Identify new applications and opportunities to reduce costs for HVDC and FACTS.
- Develop operational, maintenance, and replacement strategies for HVDC and FACTS.

Member Benefits

- Research results to help with the construction and operation of cost-effective HVDC and FACTS infrastructures.
- Data to help in selecting an optimal option (HVDC or HVAC with FACTS) for members' utility systems.
- Increased overall system controllability, stability, and reliability by using HVDC and FACTS.
- Newly developed concepts, such as DC grids and DC circuit breakers to support a smart grid, including renewable integration.

This project assesses and evaluates high-voltage direct-current (HVDC) and flexible alternating-current transmission systems (FACTS) technologies. HVDC and FACTS technologies offer options to increase the transmission capacity of existing lines. A dc transmission system also provides an effective alternative for integrating renewable resources, increasing the overall power system reliability, and transferring bulk power.

Significant advancements in HVDC and FACTS technologies have been made in recent years—for example, the development of voltage-source converter (VSC) technology. As HVDC transmission systems and FACTS are planned, built, and refurbished, it is important that the power industry have access to the latest technologies and options to make proper decisions. Guidelines are needed to match applications with available approaches and to guide members in the selection between an ac or dc system. Research is also needed to address the challenges with and reduce the costs of HVDC and FACTS controllers, which will increase their applications.

EPRI has been conducting investigations and developing reference materials that capture and consolidate the experience and knowledge of the industry on HVDC and FACTS technologies. EPRI continues to build a comprehensive library of information on HVDC and FACTS technologies for the benefit of the power industry.

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Research Highlights



HVDC Reference Book

Information is being developed for the *EPRI High Voltage Direct Current (HVDC) Transmission Reference Book* (also known as the [Olive Book](#)). HVDC Reference Book updates incorporate new developments and experiences and assist users in specifying HVDC system components, designing overhead lines, and assessing existing HVDC systems for life extension options. In 2024, EPRI plans to update the chapters on converter cost estimates and electrical effects with the latest information obtained from testing.



Performance and Cost Comparison of FACTS Controllers

Comparison of the performance and costs of FACTS controllers such as Static Var Compensator (SVC), Static Synchronous Compensator (STATCOM), Thyristor Controlled Series Compensator (TCSC), Static Synchronous Series Compensator (SSSC), Unified Power Flow Controller (UPFC), and Interline Power Flow Controller (IPFC) were performed in the previous years. In 2024, the application of STATCOM with energy storage will be studied and documented. Several case studies will be developed with different FACTS device applications for power grid including renewable applications in 2024 and beyond.



Best Practices for Operation, Maintenance, and Refurbishment for Life Extension of FACTS Controllers – SVC and STATCOM Life Extension Guidelines

This task systematically identifies needs in the operation, maintenance, and replacement of FACTS controllers. Initially, utilities with existing FACTS controllers might be surveyed to understand the existing maintenance and operation practices, and their needs documented and prioritized. Based on the survey results, best practices for operation and maintenance as well as replacement strategies may be developed. Plug-and-play components, which are vendor-independent, are necessary to facilitate upgrades of FACTS controllers. In 2024, life extension guidelines and techniques to improve operation, maintenance, and refurbishment of SVCs and STATCOMs will be developed.

For more information, contact:

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