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# Power Systems Engineering Seminar Series

# FACTS AND HVDC SEMINAR
## SYSTEM PLANNING AND EQUIPMENT APPLICATIONS

**OVERVIEW**: Improved utilization of the existing power system is provided through the application of advanced control technologies. Power electronics based equipment, such as Flexible AC Transmission Systems (FACTS), High Voltage DC (HVDC), and Custom Power (CP) equipment provide proven technical solutions to address new operating challenges being encountered today. These technologies allow for improved transmission system capability and operation with minimal infrastructure investment, environmental impact, and implementation time compared to the construction and cost of new transmission lines.

Today's challenges and system requirements necessitate upgrades to the electrical transmission system infrastructure to provide enhanced system capacity, operation, and control to maintain a stable, secure, and reliable electric supply. Implementing FACTS, HVDC, and CP technologies, as *part* of an overall comprehensive strategic solution to transmission infrastructure improvements, can provide numerous benefits for transmission owners and operators, as well as for consumers.

**TOPICS COVERED**: The seminar is divided into four parts:

### *I. INTRODUCTION - CONTROL OF POWER SYSTEMS*

- Introduction to Control of Power Systems
- Power System Performance Problems
- Power System Controllability
- System Analysis Requirements (Problems vs Solutions)
- The Need for Speed: When to Choose FACTS Controllers Over Conventional Equipment
- Phases of Power System Studies for FACTS Projects
- History of Utility Applications

### *II. FUNDAMENTALS OF POWER ELECTRONICS*

- Power Electronics Terminology and Definitions
- History of Power Electronics Diodes and Thyristors
- Power Semiconductors
  - Thyristor (LTT, ETT), GTO, GCT, IGBT, others
- Control Characteristics and Circuit Design

### *III. FACTS/HVDC SOLUTIONS – FUNCTIONS AND APPLICATIONS*

- Shunt Compensation
  - Shunt Capacitor Banks
  - Static Var Compensator (SVC)
  - Voltage Sourced Converter Technology (STATCOM)
  - STATCOM versus SVC
  - Application and Installation Issues and Examples
- Series Compensation
  - Series Capacitors
  - Thyristor-Controlled Series Capacitors (TCSC)
  - UPFC, SSSC, others
  - Application and Installation Issues and Examples
- Coordinated Control of FACTS and Mechanical Devices
- HVDC
  - Back-to-Back Systems
  - VSC versus Conventional Technology
  - Recent Advances in HVDC Transmission

### *IV. POWER QUALITY ISSUES AND CUSTOM POWER SOLUTIONS*

- Basic Design Concepts, Technology, and Applications
- Distribution Static Compensation
  - D-STATCOM and D-SVC
- Solid-State Transfer Switch and Breakers

**Who Should Attend** - This seminar is designed to cover a wide range of topics on FACTS, HVDC, and CP equipment from both the system planning *and* equipment application/installation perspectives. Engineers and engineering managers involved in Planning, Operation, Substation, Projects, Apparatus, Protection, and related functions dealing with utility transmission/distribution systems would greatly benefit from the practical information presented in this seminar.

**LENGTH**: 1 to 3 day versions of this seminar are available depending on the customization of the course material to suit specific interests identified.