Course on High Voltage Direct Current (HVDC) Transmission

Place: Southern California Edison
14799 Chestnut Street, Westminster, CA 92683
Time: 4 days, August 9-12, 2011

Day 1:

1. Introduction to HVDC
    a. What is HVDC?
    b. Advantages and Disadvantages of DC Transmission
    c. For which Applications is HVDC recommended?
        i. Typical Examples of HVDC Transmission around the world
2. Basics of HVDC-LCC Converters
    a. Understanding of Converter Operation
        i. Delay angle, overlap angle and extinction angle
        ii. Rectifier and Inverter Operation
    b. Converter current and voltage waveforms
    c. Converter equations and their use
    d. Hands-on tutorial (Rectifier and Inverter Operation)
3. The HVDC Converter Connected into the AC Network
    a. HVDC Converter Arrangements
        i. Pole, Bipole, Back-back etc.
    b. The Impact of AC System Strength on Converter Operation
        i. Load rejection Overvoltages
        ii. Commutation Failure
        iii. Harmonic instability

Day 2:

4. HVDC Control Principles
    a. Pole and Valve-group level Controls
        i. Current Control
        ii. Extinction angle Control
        iii. Current-error control
    b. Bipole Level Controls
        i. Power Control
        ii. Auxiliary Controls
    c. Hands-on tutorial (Control of a point-to-point HVDC Transmission Scheme)

5. HVDC System Measurements and Protection
    a. HVDC System Measurements:
        i. Measurement of firing and extinction angles
        ii. Detection of Commutation Failure

b. HVDC-specific protection aspects (Does not include aspects of AC system protection common to AC systems)
    i. HVDC line faults
    ii. Response to commutation failures and recovery
c. Hands-on tutorial (Recovery from HVDC Line fault)

Day 3:

6. Reactive Power and AC Filters
    a. Reactive Power requirements at HVDC stations.
    b. Reactive Power Supply Options
    c. Harmonics of HVDC Converters
    d. Hands-on tutorial (Measurement of Converters harmonics for different operating conditions)
    e. Filter Design,
    f. Filter Switching Coordination
    g. Hands-on tutorial (Filter Current Waveforms, Filter Switching Coordination with DC loading)
7. Limits to Operation: Steady-state Stability Limits
    a. Maximum Power Curves and Maximum Available Power (MAP)
    b. Control Sensitivity Indices for Stability Analysis

Day 4:

8. New HVDC Topologies
    a. HVDC with Capacitor Commutated Converters
        i. The Capacitor Commutated Converter (CCC)
        ii. The Controlled Series Capacitor Commutated Converter (CSCC)
    b. Voltage Sourced Converters (VSC)
        i. Advantages and Disadvantages of VSC Transmission
        ii. VSC arrangements
            1. Multi pulse converters with Pulse-width modulation
            2. Multi-level Converters (Modular Multi-level Converters MMC)
        iii. Control of VSC-HVDC Systems
        iv. Applications of VSC

    c. *Hands-on tutorial (VSC HVDC transmission scheme)*

    d. General Discussion

Registration Details

- Class size is limited to 15 participants.
- Fees: $2,500/person. 10% discount for multiple participants from the same organization. Fee includes course notes and PSCAD examples.

Please contact us for availability of seats, fee payment and registration details.

Attn: Aung P. Thant
Nayak Corporation
475 Wall Street
Princeton, NJ 08540
Ph: (609) 279-9050
training@nayakcorp.com

Instructor:

Principle:

Dr. A. M. Gole, Professor, University of Manitoba

Dr. Gole holds the NSERC/Manitoba Hydro Industrial Research Chair in Power Systems Simulation at the University of Manitoba, Canada. He has over 30 years experience in HVDC Transmission and FACTS technologies and in addition to his University employment, he has worked at Manitoba Hydro, Hydro Quebec (IREQ), and the Manitoba HVDC Research Centre. He has a long term involvement with the development of off-line and real–time tools for Power System simulation, and was a member of the original design team that developed the PSCAD/EMTDC program.

Dr. Gole holds a B.Tech. (EE) degree from the Indian Institute of Technology (IIT), Bombay, India; and a Ph.D. from the University of Manitoba, Canada. He is a Fellow of the IEEE and the year 2007 recipient of the IEEE PES Nari Hingorani FACTS Award.

Assistant:

Mr. Aung P Thant, Simulation Engineer, Nayak Corporation

Mr. Aung Phyo Thant received his Bachelors and Masters degrees in Electrical Engineering from New York University (NYU) in 2008 specializing in power systems modeling and simulation. He joined Nayak Corporation in the USA soon after his graduation. As Simulation Engineer at Nayak, he is responsible for providing technical support and training courses for all PSCAD users worldwide. He has also worked on several consulting projects involving capacitor switching studies, transient overvoltage and harmonic resonance studies for wind farms and PV systems using PSCAD.