



Southern Alberta Section
IAS-PES Chapter



Power Systems for Non Power System Engineer

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Overview

This seminar presents the electric power system at a fundamental component level. The seminar covers planning, equipment characteristics, how the power system equipment works and fits together. The seminar is illustrated with real life examples from the seminar presenter's extensive experience. Other components of the power system – NERC, Reliability, Protection and Blackouts are discussed and illustrated.

How Canada's two deregulated markets work is discussed and illustrated.

What future challenge does the power system face is discussed and illustrated.

The power system is presented from a unique perspective. The emphasis is on the physical attributes of the power system equipment. Although mathematics is used to illustrate some aspects, mathematics is kept to a minimum.

Shortcut methods are illustrated that will allow the engineer to develop an understanding of the problems they are facing.

Class exercises are provided to illustrate the topics covered.

Learning Objectives

The main learning objective is to give the participant an understanding of the physical aspects of power system components, how they work and what the power system engineers do. This will allow the seminar participant to ask the right questions with the ultimate objective of saving time and money.

Target audience is engineers needing to know more about the power system because of their load, self-generation, interaction with the utility and AESO. Junior engineers would also benefit from this seminar.

For the practicing engineer the seminar's secondary theme is 'put pencil to paper before fingers on the keyboard.'

Location: The Carriage House Inn
Surrey Room

9030 Macleod Trail South
Calgary, Alberta

Date: Monday, February 22, 2016 to Tuesday, February 23, 2016

Time: 8:30AM to 4:30PM All times are: Canada/Mountain
Lunch is included.

Register at: <https://meetings.vtools.ieee.org/m/36537>

Speaker:



Bill Kennedy

The seminar leader is W.O. (Bill) Kennedy, P.Eng. FEIC. Bill has over 45 years' experience in the electric power industry. He has worked in the deregulated electric industry in Alberta since 1997, first for ESBI Alberta Ltd. and then AESO. In 2005, he reestablished his consulting practice and assists Clients in the four western provinces in their dealings with utilities and other entities. Prior to that he worked for a utility where he held positions as head of the Protection Department and Transmission Planning Manager. His experience includes work on projects in nine of Canada's ten provinces. He has worked internationally on projects in Pakistan, Iran, Peru and the former Yugoslavia. His expertise has been recognized by the Engineering Institute of Canada when he was made a Fellow in 1998, IEEE Canada where he was awarded the Outstanding Engineer Medal in 2014 and the Power Medal in 2015. The latter 'for outstanding contributions to the practice of power system protection and planning.' Active in IEEE, he is a past Director of Region 7 (Canada) and Division VII (PES). He is a Life Senior Member of IEEE.

Please contact Mirza Danish Baig [mirzadanishbaig@gmail.com] if you have any problems registering for the seminar, or if you have any questions.

Detailed Seminar Agenda:

The seminar will be presented over two day period from 08:30 to 16:30. Fifteen minute morning and afternoon breaks are included. Lunch will be 45 minutes.

Attendees should bring a calculator and be prepared to work on class assigned exercises.

Day 1

1. Introduction
 - a. What is the power system – a simple model
 - b. Overview of Canadian electric systems
2. Basic Electricity
 - a. Voltage
 - b. Current
 - c. Resistance and Impedance
 - d. ELI the ICE man
 - e. Circuits & Components
 - f. Kirchhoff's Laws
 - g. Thevenin & Norton Equivalents
 - h. Power
 - i. Power Triangle
 - j. Energy
3. Planning Process
 - a. Load Forecast
 - b. Generation Forecast

- c. Generation planning in a deregulated market
- d. Transmission
- e. Substations
- f. Distribution
- g. The Plan
- 4. Generators
 - a. Blocks Diagrams
 - b. Energy Conversion
 - c. Prime Mover
 - d. Faraday's Law
 - e. Three Phase Power
 - f. Generator Control
 - g. AGC
 - h. Energy Storage
- 5. Transformers
 - a. How they work
 - b. Simple Transformer – one source
 - c. Mutual Impedance
 - d. Simple Transformer – two sources
 - e. Three Phase Transformers
 - f. Transformer Connections
 - g. Autotransformers
 - h. Phase Shifting Transformers (PST)
- 6. Transmission Lines
 - a. Surge Impedance Loading
 - b. Properties of Transmission Lines
 - c. St. Clair Curve
 - i. Thermal Limits
 - ii. Voltage Limits
 - iii. Angle Limits
 - d. Conductor Selection
 - e. Conductor Ratings
 - f. Cables
- 7. HVDC
 - a. Why and Where Used
 - b. Types – LCC, VSC, hybrid
 - c. Bipole Example
- 8. Breakers
 - a. What they do
 - b. Where are they used
 - c. How they work
 - d. Insulation
- 9. Substations
 - a. What they do
 - b. Types of layouts
 - c. Examples
 - d. Some examples of what not to do
- 10. Motors
 - a. Synchronous
 - b. Induction
 - c. Starting

Day 2

11. Putting the Power System Together
 - a. Components
 - b. Characteristics
 - c. How the power system works
12. Modelling the Power System
 - a. Powerflows
 - b. Types of Studies
 - c. NERC Contingencies
 - d. Other methods – LOLE, LOLH & EUE
 - e. Text Book Example
 - f. Alberta Example
13. Stability
 - a. Maximum Power Transfer
 - b. Equal Area Criteria
 - c. Excitation Systems
 - d. Governor Systems
 - e. Other Control Systems
 - f. Feedback
14. Reactive Power
 - a. What is it?
 - b. Why is it needed?
 - c. Where do you get it?
 - d. Power Factor
 - e. Why is power factor important?
15. Protecting the Power System
 - a. What is protection?
 - b. Symmetrical Components – protection's main tool
 - c. Types of protection
 - d. Protection Square
 - e. Breaker Failure
 - f. Communication – IEC 61850
 - g. System Protection
 - i. Over/Under Voltage
 - ii. Over/Under Frequency
 - iii. Power Swings
 - h. Synch-Check
 - i. Single Phase Trip and Reclose
 - j. Special Protection & Remedial Action Schemes
 - k. Surge Arresters
16. Transmission Losses
 - a. Overview of the Alberta System
 - b. Distribution
 - c. Power System
 - d. Conductor Optimization
17. North American Electric Reliability Council (NERC)
 - a. NERC Regions
 - b. Reporting Structure
 - c. Critical Infrastructure Protection (CIP)

18. Tie Lines and Interconnections
 - a. What are they
 - b. Canadian Examples
 - c. Canada/US Interconnections
 - d. Tie Line Power and Energy Flows
 - e. Alberta Interconnections
19. Blackouts
 - a. Causes
 - b. 2003 Blackout
 - c. Some recent examples and their causes
 - d. CIGRE – Recent Work
20. Electricity Markets
 - a. Canadian Deregulation
 - b. Energy Market Overview
 - c. Alberta Market
 - d. Ontario Market
 - e. Capacity Market Overview
 - f. What's regulated; what's not?
21. Reliability
 - a. Overview
 - b. Bathtub Curve
 - c. CEA Consultative Committee on Outage Statistics (CCOS)
 - d. Some Examples
 - i. Transmission Lines
 - ii. Stations
 - iii. Generators
 - e. Redundancy
 - f. SAIDI, SAFI & SARI
22. Energy System of the Future
 - a. Eleven Drivers
 - b. Australian Example
23. Wrap Up
 - a. Summary
 - b. Questions
 - c. Evaluation