

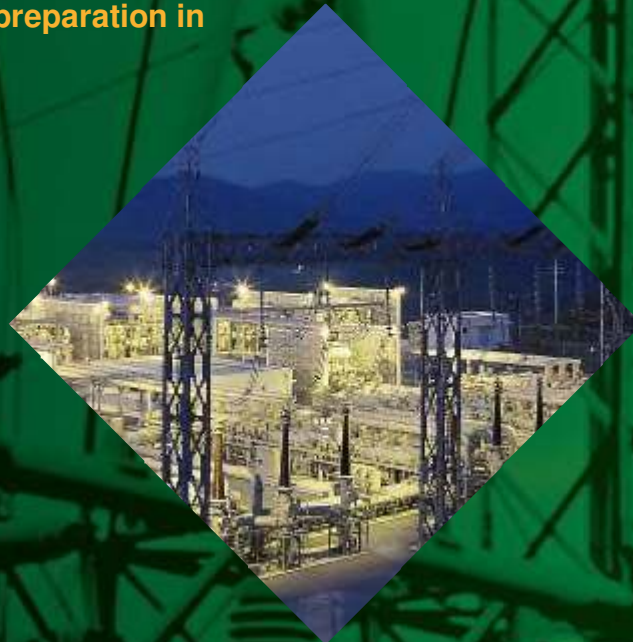
A 2-Day Professional Development Seminar on

Practical Substation Design

Who Should Attend?

Technical personnel who are involved in the design, construction, operation and maintenance of electric substations for power systems, such as

- **Electrical power system engineers, managers and technical officers**
- **Power system planners**
- **Power system consultants and contractors**
- **Power system operators**
- **Others who want a solid preparation in substation design**



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Your True Partner in Attaining Professional Excellence

Practical Substation Design

Overview

Substations play an important role in power system networks by maintaining continuity of power supply between the utility and the customers: industrial, commercial and residential. A modern high voltage substation include equipment such as circuit breakers, transformers, capacitors, reactors, and equipment for protection, control, automation and communications. A correctly planned and designed substation is essential to the reliable supply of electrical energy. Substation sites and buildings must also conform with many requirements relating to environmental, community impacts and building codes - these requirements constrain and interact with the electrical and equipment design issues.

This seminar will cover most of the important aspects of medium and high voltage substation planning and design including fundamental design philosophies, requirements and parameters, equipment selection, environmental requirements, layout of sites, switchyards and buildings, testing and commissioning, future development and trends.

Practical examples and experiences will be included in the seminar content to illustrate certain principles of design.



Seminar Presenter - Jonathan Khor



Jonathan is currently the Distribution and Contingency Planning Manager at ENERGEX in Queensland. Prior to this appointment he was Network Substation Standards Manager and managing the development of standards and policies for substation equipment. At the previous position as Principal Substation Engineer at ENERGEX, he was overseeing the design of Greenfield and refurbished substations up to 132kV.

His career in the industry spans over 20 years in two electricity corporations and in the switchgear manufacturing industry. He has had experience in specification, design, commissioning, operations and consulting aspects of substations. He has also been involved in the other aspects of the electricity distribution industry.

He has developed the High Voltage Live Working Principles for Substations in ENERGEX and has successfully discharged a contract for ENERGEX to implement High Voltage Live Line Work in Hong Kong. Jonathan is a current member of the CIGRE Australian Panel AP B3 'Substations' and has been since 2003. His is a former member of the ESAA Wood Pole Committee. He holds an Engineering Degree in Electrical and Electronic Engineering from the University of Wales, Cardiff and a Masters in Business Administration (Technology Management) Deakin University.

The course contents and materials for this course are specially designed and developed by **John Ainsworth** of Ausgrid and **Jonathan Khor** of Energex

John Ainsworth is currently Ausgrid's Engineering Policy Development Manager and has a long career with Ausgrid, formerly EnergyAustralia. He is a recognised expert in power system protection and in substation design and equipment matters.

His career includes some 50 years in all aspects of design and field protection work and in the related areas of switchgear, substation design, high voltage engineering, EMF, earthing, control schemes, testing, construction and maintenance. John is currently a member of Standards Australia committees EL007 High Voltage Switchgear, EL 8/8 High Voltage Bushings, EL043 Substations and High Voltage Installations, EL024 Lightning Protection, and Chairman of EL7/5 High Voltage Fuses. He is a recent member of CIGRE Australian Panel APB3 'Substations'.

He has lectured for the past 30 years at universities at post graduate level and within Ausgrid. He holds a Degree in Electrical Engineering from the University of NSW and has post graduate certificates in Protection Engineering, Electrical Equipment Design, and High Voltage Engineering and Testing.



REGISTER NOW! Fax your registration form to (02) 9410 0030

COURSE CONTENTS

1. General Introduction and Preface of Substations

2. Planning

- ◇ Network Requirements
- ◇ Development approvals
 - Integrated Planning Act
 - Council Approvals
- ◇ Environmental Assessment and Environmental Impact Statement
- ◇ Public Consultation
- ◇ Building Code
- ◇ Telecommunications Code

3. Electricity Codes, Requirements, Guidelines and Standards

- ◇ NEMMCO
- ◇ Electricity Regulation
- ◇ National and International Standards
- ◇ Professional Bodies

4. Hazards and Safety

- ◇ Safety Regulation
- ◇ Risk Assessment and Analysis
- ◇ Operational Safety
- ◇ Public Safety

5. Fundamental Requirements and Design Parameters

- ◇ Impedance
- ◇ Fault Level
- ◇ Regulation
- ◇ Tapping Range
- ◇ Power Factor
- ◇ Phasing

6. Primary Components – Functions and Design Issues

- ◇ Busbar Configurations
- ◇ Switchgear
- ◇ Transformers
- ◇ Capacitors
- ◇ Earthing
- ◇ Insulation
- ◇ Cables
- ◇ CT's and VT's
- ◇ Ripple Control Equipment

7. Secondary Systems – Functions and Design Issues

- ◇ Protection
- ◇ Protection Communication and Signalling
- ◇ SCADA/Communications
- ◇ Voltage Control
- ◇ Capacitor Control
- ◇ Batteries and Auxiliary Supply

8. Building and Associated Infrastructure

- ◇ Buildings
- ◇ Structures and foundations
- ◇ Fences
- ◇ Security systems
- ◇ Hydraulics

9. Substation Layout

- ◇ Switchyard Layout
- ◇ Configuration
- ◇ Electrical and working clearances
- ◇ Physical Access for work

10. Design Philosophies

- ◇ Drawing and Record Management
- ◇ Protection Philosophies
- ◇ Control Philosophies
- ◇ Fire issues
- ◇ Equipment Selection including Ratings

11. Equipment Selection

- ◇ Ratings
- ◇ Current rating
 - Normal
 - Cyclic
 - Emergency
- ◇ Fault rating
 - Breaking capacity
 - Through fault I²t
- ◇ Insulation rating
- ◇ De-Rating factors
- ◇ Switching ratings
- ◇ Mechanical loading
 - Wind
 - Seismic
- ◇ Harmonics
- ◇ Noise Rating

12. Testing and Commissioning

- ◇ Factory Acceptance Testing of Equipment
- ◇ Site Testing and Commissioning
- ◇ Pre-commissioning
- ◇ Commissioning

13. Operational and Maintenance Requirement

- ◇ Network Configuration
- ◇ Network Constraints
- ◇ Staging of Works

14. Environmental

- ◇ Construction Requirements
- ◇ EMF
- ◇ Noise
- ◇ Aesthetics

15. Future Developments, Technologies, Trends, Innovations

- ◇ Low Loss Transformers
- ◇ Alternatives to SF₆ Insulating Medium
- ◇ High Voltage Live Work in Substations
- ◇ IEC 61850
- ◇ Gas Insulated Transformers and Gas Insulated Cables
- ◇ Superconducting cables
- ◇ Low flammability/High flashpoint Insulating Oils

CPD Recognition

This seminar program is specially designed to meet the Continuing Professional Development (CPD) needs of participants. A certificate of attendance will be awarded at the end of the program. This serves as evidence of your personal and professional commitment to your career.