UNDERGROUND HV SUBSTATION DESIGN

27 – 31 MARCH 2017, SINGAPORE

TOPICS INCLUDE

- Underground Substations Overview
- Planning New Underground Substations
- S/S Design Overview
- S/S Feasibility of Underground SS Design
- Technical Specification for an Underground SS
- Tendering Process
- Health & Safety in Underground Projects

Expert Course Faculty Leader

Vukan Polimac
Chartered Engineer MIET CIGRE SMEIT SAIEE
Fellow of IET, IEEE, CIGRE
Consultant in Polimac Ltd

Qualified for 30 PDUs by PEB
About This Training Course

HV Substations play an important role in the electric power systems. Specific requirements are set for underground substations which are mainly designed in city centers where land, if available, is sold at a premium and it is often the only feasible way to construct it. The most common underground substation types are for major BSP and distribution substations within the DNO as well as substations supplying underground metros or business and commercial centers. Properly planned and designed substation is essential for reliable operation of a power system network. A new substation should be built to meet the requirements of the growing load and operation under the changing competitive markets. Upgrading of the existing substations would require a comprehensive knowledge of the substation as well as the overall power system. Specific requirements associated with underground installation are addressed in this course with practical examples of resolving technical challenges such as increase heating due to the electrical load and subsequent losses, planned and unplanned maintenance and provision for quick and effective equipment replacement. Safety requests include explosion and fire hazard, fire escape routes, cable routes describing the mitigating measures and specification for this environment.

This course covers all aspects of medium and high voltage substation design with the particular focus on underground substations including regulatory requirements and general design considerations from feasibility through technical specification and tendering to the detail design. A practical understanding of planning, design, technical specification application and a step by step approach of the underground substation design process is explained as well as design documentation for each design stage. Health & safety and environmental issues relevant for the underground substation design are covered in this comprehensive course.

Course Learning Overcome

- Learn the latest criteria and practical techniques for the design of Underground HV substations
- Understand a step by step approach of the substation design process from initial site survey, underground substation concept, technical specification to the detail design of equipment
- Gain knowledge of the technical requirements, configuration philosophies
- Gain knowledge of design practices and work processes
- Learn how to specify equipment for a new underground substation
- Learn how to manage the underground substation design
- Have a comprehensive understanding of specific substation components
- Gain knowledge of underground substation layout and busbar design
- Help engineers and technicians to work with confidence to ensure continuous supply with complete reliability by minimizing interruptions
- Understand the safety considerations of underground substations
- Understand the environmental aspects of underground substation design and critical factors involved
- Gain knowledge of reliability considerations and maintenance considerations in the design stage
- Understand the technical aspects involved in the selection of major equipment in underground substations
- Gain knowledge of specific substation earthing design
- Understand design documentation from general arrangement to schematic diagrams
- Learn how to manage the design

Who Should Attend

- Design Engineers/Technicians in DNO and Metro transportation companies
- Industrial and Utility Engineers/Technicians
- Managers of design engineering departments
- Electrical Engineers/Technicians
- Commissioning Engineers/Technicians
- Consulting Engineers/Technicians
- Planners of Power Systems
- Project Engineers
- Safety Professionals
- Others who want a knowledge of a substation design
5 Day Course Outline

**DAY 1**

**Introduction**

**Underground Substations Overview**
- Substations in Power Systems
- Substations Overview
- Substation Types

**Planning New Underground Substations**
- Planning Overview
- Planning Methodology
- Power System Design

**S/S Design Overview**
- S/S Design Overview
- S/S Design Structural Diagram

**S/S Feasibility of Underground SS Design**
- Site Selection
- Feasibility Optimal Design
- Appraisal
- Feasibility Design Example

**DAY 2**

**Technical Specification**
- Specification Concept for Underground SS
- General Requirements
- Specifying Plant
- Specification for Switchgear
- Specification for Transformers
- Specification for HV Connections
- Specification for S/S Earthing System

**DAY 3**

**Technical Specification for an Underground SS**
- Specification for LVAC Supply
- Specification for LVDC Supply
- Specification for Protection
- Specification for Control
- Specification for Civil Works

**Tendering Process**
- Inquiry Document
- Tender Criteria
- Tender Review
- Contract Award

**Health & Safety in Underground Projects**
- Methodology for H&S
- Managing Health & Safety in Projects
- Designer Duties
- Health & Safety Plan
- Risk Assessment

**DAY 4**

**Initial Contract Design**
- Overview
- Single Line Diagrams
- Layouts
- S/S Earthing System
- Selecting HV Switchgear
- Transformers
- Selecting HV Connections
- Selecting Protection
- Selecting Control System
- Selecting Multicore Cables

**DAY 5**

**Health & Safety in the Contract Design**

**Managing Design**
- Detail Design Documentation
- Competency in the Design
- Design Coordination
- Design Approvals

**Detail Design**
- Detail Design Overview
- Civil Design
- LVAC System
- LVDC System
- Switchgear
- Transformers
- HV Connections
- Protection
- Control System

**Design Support in the Construction**

Course Summary & Closure
Your Expert Faculty

Vukan Polimac
In his 30 years working experience he provided highest quality services in system planning and analysis to major transmission and distribution and transportation companies including London Underground, National Grid Company (UK), MTRC Metro in Hong Kong, West Coast Main Line connection to NG, Scottish Power, ESB-Ireland, ESKOM-South Africa, Mauritius CEB, Balkan countries - grids of Romania and former Yugoslavia, HV network ISA-Colombia, Western Power Distribution-UK, etc.

Vukan’s technical expertise includes most aspects of power systems analysis, electrical asset management and railway connections to power networks where he provides solutions to technical problems and supports other field’s experts in complex assignments. He has project management skills in technical and environmental projects as well as experience in short and long-strategic term planning, maintenance and asset management, power quality analysis of transmission and generation systems, distribution, transportation and other power networks. Experienced in generation and network integration, electrical component of energy master plans as well as strategic asset replacement, he was also involved in load- forecast analysis and generation dispatching. Published papers on asset management based on projects and experience in working for distribution companies in Africa and Europe.

Vukan is very experienced in design, procurement, commissioning, erection and refurbishment of major projects in transmission and distribution substations up to 420 kV and hydro and thermal power plants. Served as project manager on several major projects as well as head of the Engineering Group, Vukan was responsible for final design, equipment specifications, layouts tender evaluation and commissioning. He has carried out conceptual development of protection and control philosophy for various projects as well as reviewed and approved project drawings and documents. He has applied the latest IEC standards, various codes of practice and engineering recommendations. He has also specific experience in conceptual design of power supply for transportation and traction railway systems, defining the design principles and technical specifications for future design and privatisation process. He has analysed quality of power supply for connection of AC and DC unbalanced load to power network and published papers on practical implementation. Vukan carried out feasibility studies on reactive compensation (SVC and MSC) focusing on voltage variation and harmonic distortion issues.

Vukan has performed technical and economic evaluations, cost benefit net present value analysis, of various transmission and distribution schemes and electrical equipment. He carried out a number of asset evaluation analysis on electrical equipment and published papers on asset management, reliability and maintenance. He has performed equipment assessment and residual life prediction as part of strategic asset management analysis for a major underground transportation company in Asia. His duties have also included equipment arrangement optimisation in particular reliability aspect in terms of failure rate and financial consequences as non-supplied energy to the consumers.
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does PowerEdge have other programmes than those listed?</td>
<td>We have more than 200 programmes that we are capable of running. All we need is for you to contact us and request for the preferred programme and we will able to develop it.</td>
</tr>
<tr>
<td>2. Where is PowerEdge based?</td>
<td>PowerEDGE is headquartered in Singapore but we run our training programmes in different venues around Asia.</td>
</tr>
<tr>
<td>3. What does PowerEdge do?</td>
<td>We are a Power &amp; Utilities Training Specialist.</td>
</tr>
<tr>
<td>4. Can this course be done in our city?</td>
<td>It absolutely can. Get in touch with us to request for a training programme to be carried out in your city.</td>
</tr>
<tr>
<td>5. Can you reduce the price of our preferred course?</td>
<td>While our price has been reduced before it is even launched, we are always happy to help you with further discounts.</td>
</tr>
<tr>
<td>6. Can you change the dates of the course?</td>
<td>If you have a special requested date, let us know and we will arrange another session for you.</td>
</tr>
<tr>
<td>7. Who are the companies that will be participating?</td>
<td>This varies from a diversity of Power Operators, Regulators, Financiers, to Vendors in the Power &amp; Utilities industry.</td>
</tr>
<tr>
<td>8. Where is the venue for the course?</td>
<td>We usually engage a 4 to 5 star hotel meeting room to ensure the comfort of our participants.</td>
</tr>
<tr>
<td>9. How many delegates should we expect for each course?</td>
<td>This varies from 15 to 20 participants. Class sizes are kept small to allow trainers to focus better on each participant.</td>
</tr>
<tr>
<td>10. What are the different payment modes?</td>
<td>We accept Visa/MasterCard, cheques, bank transfers and cash on site.</td>
</tr>
<tr>
<td>11. Is accommodation included when I sign up for a course?</td>
<td>Accommodation is not included in the course fee but we are always happy to advise on available accommodations.</td>
</tr>
<tr>
<td>12. Can I get a cheaper accommodation through PowerEdge?</td>
<td>We will be pleased to help you negotiate a better rate with hotels.</td>
</tr>
<tr>
<td>13. Is lunch provided during the course?</td>
<td>We provide lunch and 2 tea breaks every day during our training programmes.</td>
</tr>
<tr>
<td>14. Are the training materials included once I have signed up for a course?</td>
<td>Yes, training and course materials are included in the course fee.</td>
</tr>
<tr>
<td>15. Will there be a certificate for the course?</td>
<td>Yes, there will be a certificate of participation upon completion of a course.</td>
</tr>
<tr>
<td>16. Who are PowerEdge trainers?</td>
<td>They are expert consultants and practitioners with many years of experience in the subject matter that they deliver on.</td>
</tr>
<tr>
<td>17. Are PowerEdge trainers competent?</td>
<td>We have received numerous favourable feedbacks on our trainers from past participants.</td>
</tr>
<tr>
<td>18. Can PowerEdge assist with Visa travel applications?</td>
<td>We can assist in advising you on the relevant procedure(s) and embassies/consulates that provide Visa for travel purposes.</td>
</tr>
<tr>
<td>19. Can we purchase training materials without attending a course?</td>
<td>Unfortunately this option is not available as training materials are specially developed for courses.</td>
</tr>
<tr>
<td>20. Can course content be tweaked to cater to our needs?</td>
<td>Of course! Just let us know your request and we will get the trainer to assist in carrying it out.</td>
</tr>
</tbody>
</table>
# UNDERGROUND HV SUBSTATION DESIGN

**27 – 31 MARCH 2017, SINGAPORE**

<table>
<thead>
<tr>
<th>PER PARTICIPANT</th>
<th>2 PARTICIPANTS OR MORE</th>
<th>IN-HOUSE TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Day Programme</td>
<td></td>
<td>Guaranteed Minimum 40% Off Normal Price</td>
</tr>
<tr>
<td>SGD 3, 300</td>
<td>SGD 2, 800</td>
<td></td>
</tr>
<tr>
<td>Per Participant</td>
<td>Per Participant</td>
<td></td>
</tr>
</tbody>
</table>

**Guaranteed Minimum 40% Off Normal Price**

| *SGD 3, 531       | *SGD 2, 996           |
| Per Participant   | Per Participant       |
| (GST Inclusive)    | (GST Inclusive)       |

*GST FOR SINGAPORE REGISTERED COMPANIES ONLY

## ATTENDEE DETAILS

<table>
<thead>
<tr>
<th>Name</th>
<th>Job title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Job title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Job title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## COMPANY DETAILS

<table>
<thead>
<tr>
<th>Organisation name</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Postcode</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tel</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## PAYMENT METHODS

- **Cheque/ Bank Draft:** Make Payable to PowerEdge Pte Ltd.
- **Bank Transfer:**
  - Bank Code: 7339 Branch code: 686 Account Number: 686-253386-001 S
  - Swift Code: OCBCSGSG
- **Bank Address:** 65 Chulia Street OCBC Centre, Singapore 049513
- All bank charges and payment in Singapore dollars (SGD) to be borne by payer. Please ensure that PowerEdge Pte Ltd receive the full invoiced amount.

## Related Training

- **Keeping Electrical Switchgear Safe**
- **Introduction to Power Systems**
- **Excitation Systems**
- **Fundamentals of Power Generation**

## On Site Training

- **Can’t make it for the Course? We’ll make the course come to you!!**
- **Simply let us know your preferred time and dates and we will meet you at your schedule and venue.**
- **With a host of highly trained experts, we will be happy to customize your programme with your needs 100% fulfilled.**
- **Contact us today at info@poweredgeasia.com (65) 6741 9927**

## Payment Policy

- Payment is due in full at the time of registration. Full payment is mandatory for event attendance. I agree to PowerEdge Pte Ltd payment terms.
- *GST: Exclusive price is only applicable for overseas corporate customers subject to qualifying conditions.*

## Online Web Registration

- [www.poweredgeasia.com](http://www.poweredgeasia.com)
- info@poweredgeasia.com
- (65) 6741 9927
- (65) 67478737

## Undergraduate

- [HV Substation Design](http://www.poweredgeasia.com)
- [HV Substation Systems](http://www.poweredgeasia.com)
- [HV Substation Generation](http://www.poweredgeasia.com)
- [HV Substation Excitation](http://www.poweredgeasia.com)

## Postgraduate

- [HV Substation Power](http://www.poweredgeasia.com)
- [HV Substation Switching](http://www.poweredgeasia.com)
- [HV Substation Protection](http://www.poweredgeasia.com)
- [HV Substation Protection](http://www.poweredgeasia.com)

## Online Training

- [HV Substation Online](http://www.poweredgeasia.com)
- [HV Substation Online](http://www.poweredgeasia.com)
- [HV Substation Online](http://www.poweredgeasia.com)
- [HV Substation Online](http://www.poweredgeasia.com)