

Fundamentals of Modern Electrical Substations

Two Days (8 PDH) Version

A Live Course on Essential Fundamentals of Electrical Substations, the Most Complex Component of Transmission and Distribution Systems

Credit: 8 PDH's (2-Day); 0.8 CEU's, 1.6 Credits

Lead Instructor: Boris Shvartsberg, Ph.D., P.E., P.M.P.

Course description

This seminar or course consisting of two 4-hour sessions, presents an overview of modern electrical substations, emphasizing their importance for reliable and effective operation of power systems, describing all major, auxiliary and control equipment, listing typical engineering issues associated with substation design and engineering and providing recommendations for addressing these issues.

This course is intended to provide participants with the following specific knowledge and skills:

- Understanding of modern power systems arrangement, including the structure of Transmission and Distribution (T&D) system
- Understanding the substation mission and its place in the overall T&D structure
- Familiarizing with the substation main components
- Understanding the role that substation auxiliary and control systems play in allowing all station equipment to function properly;
- Understanding the mission and operation principles of the following systems:
 - Relay Protection
 - Metering Systems
 - Auxiliary AC/DC Power Systems
 - Station Alarm and Remote Control Systems
- Familiarizing with the arrangement of all substation auxiliary and control systems, their advantages and disadvantages.
- Understanding the complexity of engineering aspects related to design, operation and maintenance of modern electrical substations.
- Familiarizing with typical substation engineering problems and their corresponding resolution options.

This course is designed for any engineering, management and educational professionals looking to expand their knowledge and experience in modern electrical substations:

- Electrical engineers and designers
- Colleges and universities faculty
- Utility company project management personnel
- Construction professionals

Learning Objectives & Take-Aways

1. **After attending this course**, you will be able to list typical power system voltages and describe the reasons for voltage transformation. You will get experience in calculating transformation factors for real-life power transformers.
2. **You will know** the mission of all major substation components including:
 - Power transformers
 - Switching equipment
 - Substation bus system
 - Instrument transformers

From numerous photos, you will know how all these substation components look like.

3. **You will be able** to explain when to use each type of switching equipment and list advantages and disadvantages of each type of substation bus system, including:
 - Open air rigid bus
 - Strain bus
 - Gas insulated bus
 - Cable bus
4. **You will understand** what current and potential transformers are used for and what their standard secondary values are
5. **You will know** the mission of relay protection systems, the criteria they need to meet and what types of relay protection schemes exist
6. **You will be able** to explain what breaker failure protection and reclosing are intended for
7. **You will know** the difference between analogue and digital types of metering equipment and how to calculate the real value of electrical system parameters using readings of meters and instruments
8. **You will get** experience in analyzing reliability of power supply systems
9. **You will be able** to describe typical substation switching systems, their advantages and disadvantages
10. **You will understand** the steps in substation design and engineering and get experience in selection of substation equipment

Why you shouldn't miss this course – How this course can benefit you, your organizations, and what is unique about this course:

1. Have you ever felt somewhat **inadequate and ill-equipped in your technical discussions on electrical substation subjects** with engineering professionals? If so, then this course or seminar is a must.

2. Do you, as an engineer, manager, or technician, **feel that your knowledge and understanding of different electrical substation components** is inadequate or insufficient, then you must not miss this seminar
3. How often do you get a chance to attend a workshop, course, or a seminar that is presented by the author of the numerous books on the subject matter - live? In this seminar, you will have the opportunity to interact and learn from **Dr. Boris Shvartsberg, the author of the e-books, titled, “Fundamentals of Modern Electrical Substations”** and **“Electrical Substations for Beginners”** (These books may be obtained at additional cost)
4. How often do you get an **opportunity to understand abstract and complex electrical concepts through relatively simple analogies and explanation, to see how all kind of electrical equipment looks like without visiting an actual substation?** This seminar will provide you that invaluable opportunity.
5. Some workshops and seminars end up being monotonous monologues from the presenter to the audience. Not this one. **In this seminar, you will get an opportunity to exercise the skills and concepts through classwork and engage the instructor in discussions.**
6. **Last, but not least** – If you are **not** a licensed Professional Engineer, but aspire to be one, and if you are rusty in the fundamentals of electrical substations, then this two (2) day course could serve as a **“warm-up”** on some of the electrical engineering principles, concepts and problem analyses techniques.

Who should attend:

- **Licensed Professional Engineers**, who need to meet the annual or biennial license renewal PDH (Professional Development Hour) or CEU (Continuing Education Units) requirements.
- **Engineers and Architects** who do not possess current working knowledge of electrical substations.
- **Facility Managers, Engineering Managers, Program/Project Managers and other executives** or leaders who feel a lack of adequate knowledge on electrical substation topics to hold meaningful discussions and to make informed decisions while interacting with their electrical subordinates or colleagues.
- **Non-engineers**, including **technical writers** responsible for developing operations and maintenance manuals for electrical substation equipment.
- **Procurement/purchasing professionals** who are responsible for acquisition of electrical substation equipment.

- Candidates aspiring to take the **FE or PE exams**.
- **Energy Managers and Construction Managers**.
- **Maintenance Engineers and Maintenance Managers**.
- **Patent attorneys** and attorneys who specialize in electrical facility construction, workplace safety workmanship litigation cases.
- **Other professionals** whose annual **PLP, Performance and Learning Program**, includes engineering/technical courses/seminars/workshops.

Instructor Bio:

Boris Shvartsberg, Ph.D., P.E., P.M.P.

Dr. Shvartsberg is an engineering and project management professional with more than 35 years of practical experience in managing and supervising of highly complicated technical projects for utility companies in USA and Latvia. He has an extensive teaching experience in the European and US colleges and universities. Mr. Shvartsberg is an author of more than 25 publications on electrical engineering and project management subjects. He made numerous successful presentations at International conferences and symposiums.

Dr. Shvartsberg has a doctorate and a master's degree in Electrical Engineering. He is a licensed Professional Engineer in the State of New Jersey, USA and a certified Project Management Professional designated by the Project Management Institute (PMI). He is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE).

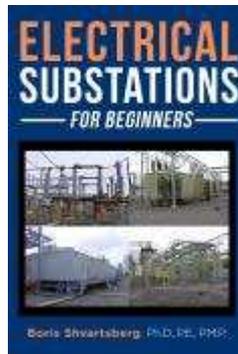
Dr. Shvartsberg develops and instructs PDH (Professional Development Hour) and, continuing education, engineering skill building courses. He conducts these courses in form of webinars, live on-site presentations, workshops and self-study texts. Some his major clients include **PGS Energy Training, CED, PDH Source, EduMind School of PE and International Institute for Learning**.

Dr. Shvartsberg has also developed and published several self-study e-books that cater to the continuous professional development needs of Engineers, Technicians and Technical Managers.

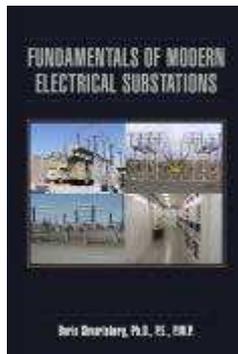
Dr. Shvartsberg's last full-time employment before retirement in 2014, was at Public Service Electric and Gas (PSE&G), Fortune 500 Energy Utility Company, where he served as a project manager and technical leader for the design and construction of substation and switching station projects. During his 25-year long career at PSE&G, he managed numerous critical projects and developed solutions for highly complex technical problems associated with electrical substation design, engineering and construction. He also provided consultation and training services in electrical engineering and project management.

Dr. Shvartsberg publications in e-book format include: (Available through Amazon.com)

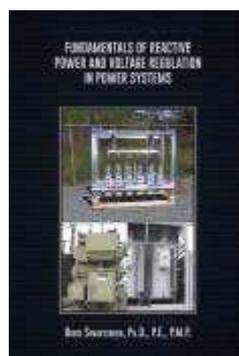
1. Electrical Substations for Beginners



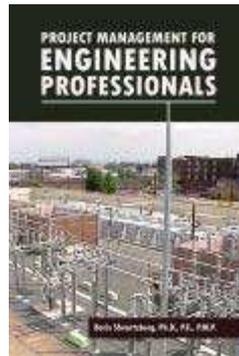
2. Fundamentals of Modern Electrical Substations



3. Fundamentals of Reactive Power and Voltage Regulation in Power Systems



4. Project Management for Engineering Professionals



5. How to Use Earned Value Management (EVM) for Effective Project Control

