Training Services 2020

Power Consulting
ABB Power Grids
Power Consulting

ABB Power Grids is a pioneering technology leader that works closely with utility, industry, transportation and infrastructure customers to write the future of industrial digitalization and to capture value.

Within ABB Power Grids, Power Consulting measures success by what matters to our customers. Our consultants combine global industry expertise with a commitment to helping clients safely and efficiently achieve their electrification objectives.

We help address issues of electrical network strategy, planning, operations, capacity building, efficiency, stability, security, reliability, and resiliency, by assessing these issues and training our clients in these areas.

Power Consulting operates independently from other ABB units allowing us to be product and system agnostic while maintaining a deep knowledge of and familiarity with technologies, standards, and local grid codes from around the world.

Power Consulting has offices in 8 countries supporting customer efforts from renewables integration to energy economics and asset management.

We can help identify the challenges of today’s power systems and recommend solutions for your specific needs, helping you address your unique challenges to capitalise on great opportunities.

We have provided solutions for customers across six continents giving us a unique, first-hand perspective on the complex political and regulatory environments that our customers face.

We have helped every type of business — from large, multinational utilities to small and medium-sized municipalities and cooperatives, from manufacturers to hospitals — solve their toughest power challenges.

Power Consulting has offices in 8 countries supporting customer efforts from renewables integration to energy economics and asset management.

Training Services

Who we are

About us
Power Grids training experts from Power Consulting units worldwide.

Our teachers
• Power Grids Consultants and other professionals
• Well-known specialists from the utility, industrial and academic arenas

Our facilities
• The Power Technologies Experience Centre in Vadodara (India)
• Training facilities at ABB’s Power Consulting premises in USA, Brazil, UK, Spain, Sweden, Germany, India and China
• Training sessions at clients’ premises

Our clients
• 71,000 students
• 500 courses
• 300 international clients
• 8,500 university students from leading institutes across India
## Training Services
### What we do

#### Open courses
We offer a range of technical courses from the fundamentals of electrical engineering to the design of the most critical systems within electrical infrastructures.

Any interested professional can join these open courses which have a fixed programme, price, dates and location for 2020.

#### On-demand courses and workshops
We combine our open courses with a wider range of technical courses that have a fixed programme but can be organised for your company at any preferred date throughout 2020.

Most of our on-demand courses can take place at our headquarters in Spain, UK, Germany, India or the USA, although we can also organise them at your premises.

#### Tailored courses
We develop specific training programmes adapted to your staff, activities and needs. Based on your requirements and our experience, we can design customised courses within ABB facilities or at your premises.

The course content can be tailored to provide a specific answer to a one time need, or to include courses in the ABB catalogue, or even to define learning paths that combine several courses presented over a period of time.

#### On-line trainings and webinars
Our courses can also be developed in an e-learning format depending on your needs, allowing you to work self-paced. We also offer a series of free webinars throughout the year that you can attend to stay updated with the latest hot topics in the energy world.

### A wide range of formats and courses to meet our customers’ requirements

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### Training Services 2020 open courses

#### OPEN COURSES

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Days</th>
<th>Dates</th>
<th>Location</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Power Grids</td>
<td></td>
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</tr>
<tr>
<td>eMobility: challenges and opportunities</td>
<td>3</td>
<td>1-2 Apr</td>
<td>Madrid, ES</td>
<td>1,380 EUR</td>
</tr>
<tr>
<td>Decentralisation, digitalisation and decarbonisation of the energy sector</td>
<td>3</td>
<td>12-14 May</td>
<td>Madrid, ES</td>
<td>1,620 EUR</td>
</tr>
<tr>
<td>The EU grid codes requirements and their application</td>
<td>1</td>
<td>26 Mar</td>
<td>Mannheim, DE</td>
<td>990 EUR</td>
</tr>
<tr>
<td>Smart transportation</td>
<td>2</td>
<td>17-18 Nov</td>
<td>Madrid, ES</td>
<td>1,380 EUR</td>
</tr>
<tr>
<td>Decentralisation, digitalisation and decarbonisation of the energy sector</td>
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<tr>
<td>Systems Engineering</td>
<td></td>
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<tr>
<td>Grounding systems</td>
<td>3</td>
<td>19-21 May</td>
<td>Madrid, ES</td>
<td>1,480 EUR</td>
</tr>
<tr>
<td>Protection for electric power systems</td>
<td>4</td>
<td>21-24 Apr</td>
<td>Madrid, ES</td>
<td>1,480 EUR</td>
</tr>
<tr>
<td>Overvoltage and insulation coordination</td>
<td>3</td>
<td>22-23 Jun</td>
<td>Stone, UK</td>
<td>1,250 EUR</td>
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<tr>
<td></td>
<td>3</td>
<td>6-7 Oct</td>
<td>Madrid, ES</td>
<td>1,480 EUR</td>
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<tr>
<td>Protection Coordination and arc flash hazard analysis</td>
<td>2</td>
<td>14-15 May</td>
<td>Stone, UK</td>
<td>1,250 EUR</td>
</tr>
<tr>
<td>Substation engineering</td>
<td>1</td>
<td>18 May &amp; 14 Sep</td>
<td>Vadodara, IN</td>
<td>600 USD</td>
</tr>
<tr>
<td>Power system earthing</td>
<td>2</td>
<td>19-20 May &amp; 15-16 Sep</td>
<td>Vadodara, IN</td>
<td>980 USD</td>
</tr>
<tr>
<td>Equipment Management &amp; Safety</td>
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<tr>
<td>HV&amp;MV Switchgear and Power Transformers</td>
<td>5</td>
<td>17-21 Feb &amp; 6-10 Jul &amp; 6-10 Nov</td>
<td>Vadodara, IN</td>
<td>2,750 USD</td>
</tr>
<tr>
<td>Operation, maintenance and condition monitoring of switchyard equipment</td>
<td>5</td>
<td>10-14 Feb &amp; 6-10 Apr &amp; 17-21 Aug</td>
<td>Vadodara, IN</td>
<td>2,750 USD</td>
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<tr>
<td>Transformer maintenance and diagnosis</td>
<td>3</td>
<td>10-12 Mar</td>
<td>Bilbao, ES</td>
<td>1,620 EUR</td>
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<tr>
<td>Power transformers</td>
<td>5</td>
<td>16-20 Mar &amp; 13-17 Jul</td>
<td>Vadodara, IN</td>
<td>2,750 USD</td>
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<td>2</td>
<td>2-3 Apr &amp; 1-2 Jun &amp; 5-6 Oct</td>
<td>Vadodara, IN</td>
<td>980 USD</td>
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<tr>
<td>Site Management</td>
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<td>20-22 Apr &amp; 26-30 Sept</td>
<td>Vadodara, IN</td>
<td>1,650 USD</td>
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<tr>
<td>Planning Studies</td>
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<tr>
<td>Power System studies: planning and analysis</td>
<td>4</td>
<td>24-25 Mar</td>
<td>Madrid, ES</td>
<td>1,380 EUR</td>
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<tr>
<td></td>
<td>3</td>
<td>10-12 Jun</td>
<td>Stone, UK</td>
<td>1,275 EUR</td>
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<tr>
<td>Grid Integration of HVDC light, offshore HVDC and FACTS devices</td>
<td>2</td>
<td>24-25 Mar</td>
<td>Mannheim, DE</td>
<td>1,980 EUR</td>
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<tr>
<td>System Solutions</td>
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<tr>
<td>Introduction to voltage control and reactive power: FACTS solutions</td>
<td>3</td>
<td>8-10 Sep</td>
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<tr>
<td>Software</td>
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<tr>
<td>Introduction to NEPLAN: a power system software</td>
<td>3</td>
<td>8-10 Sep</td>
<td>Madrid, ES</td>
<td>1,380 EUR</td>
</tr>
<tr>
<td>Specialty Issues</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>A Primer for subsynchronous oscillations (SSR, SSTI, SGCI)</td>
<td>1</td>
<td>1st May</td>
<td>Raleigh, NC, USA</td>
<td>950 USD</td>
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<tr>
<td>Subsynchronous oscillations—the phenomena, studies and mitigation</td>
<td>3</td>
<td>15-17 Sept</td>
<td>Raleigh, NC, USA</td>
<td>2,100 USD</td>
</tr>
</tbody>
</table>

* Prices include a hard and a soft copy of all training material, coffee breaks and lunch during class days. Prices do not include applicable taxes.
Modern Power Grids

eMobility: challenges and opportunities

Objectives
Discover the principles of electric vehicles and the various types of battery technologies. Identify the main traction technologies and storage sizing for electrified transportation.

Audience
Any professional curious about the latest trends in e-mobility and electric transportation.

Course topics
- What are Electric Vehicles? Introduction
  - Types and main characteristics
  - Advantages of electrification over conventional drivetrains
  - Comparison of hybrid architecture technologies
- Plug-In Electric Vehicles (PEV)
  - EV deployment
  - Battery technologies
  - Charging infrastructure
  - Future trends
- Network integration of electrified transportation
  - Main impacts
  - Corrective measures
- Energy storage sizing for electrified public transportation systems
  - Storage in an electrified transport system
  - Modelling and sizing methods
  - Optimal sizing
- Electrified public transportation systems
  - Electrified route transport
  - Electrified railway transport

Date: 01-02 April 2020.
Location: Madrid, Spain.
Price: 1,380 EUR

Decentralisation, digitalisation and decarbonisation of the energy sector

Objectives
Discover today’s trends in the decentralization of the electricity market. Understand the current context of energy decarbonization and its main challenges. Deepen knowledge of key concepts of cybersecurity, big data or blockchain as applied to the electricity market.

Audience
Professionals with experience in the electricity sector interested in understanding the current context of the energy transition.

Course topics
- Decarbonisation
  - What does “decarbonisation of the economy” mean?
  - General goals of decarbonisation
  - EU goals for decarbonisation
  - National transposition of the objectives
  - On-going measures and current status
  - Challenges
- Decentralisation
  - Transition from centralised to distributed generation systems
  - New role of consumers
  - Impact on distribution networks
  - Challenges for retail electric providers
  - New stakeholders in the sector
  - Decentralisation trends
  - New regulations
- Digitalisation
  - Digitalisation in the energy sector
  - Cybersecurity
  - Digitalisation trends
  - Case Studies

Date: 12-14 May 2020.
Location: Madrid, Spain.
Price: 1,620 EUR
Modern Power Grids

The EU grid codes requirements and their application

Objectives
Delve into the technical specifics of European grid codes. Appreciate the role of generating facilities in supporting the stability and flexibility of the grid.

Audience
Engineers with basic knowledge of grid planning and renewables integration who are interested in learning about grid codes and their impact on the electricity systems.

Course topics
• Overview (scope, background and classification)
• Main connections (general principles, connection process and technical requirements)
• Generating facilities (static voltage maintenance, dynamic grid support, adaptation of active power, protective devices, verification of electrical properties, activation conditions and synchronization)

Date: 26 March 2020.
Location: Mannheim, Germany.
Price: 990 EUR

Smart transportation

Objectives
Discover the potential benefits and applications of smart transportation. Understand the technological pillars that will facilitate the transition to smart transportation. Delve into the challenges and opportunities associated with the development of electric mobility.

Audience
Professionals interested in understanding the new trends and applications of intelligent transport, digitalization and electric mobility.

Course topics
Smart transportation in cities
• Mobility as a service, micromobility, autonomous driving
• Digitalisation of transport in cities
Electrification of transportation
• Electric vehicle and its role in the energy sector decarbonization
Smart transportation in other means of transport
• Applications in railway
• Applications for a better logistics management in airports
• Applications in maritime transport
Challenges and opportunities for a deployment of smart transportation

Date: 17-18 November 2020.
Location: Madrid, Spain.
Price: 1,380 EUR
Systems Engineering

Grounding systems

Objectives
Learn the basic criteria for the safe design of earthing systems in any high voltage facility. Analysis using case studies following the international standards IEC and IEEE.

Audience
Professionals involved in the study, operation or maintenance of electrical installations.

Course topics
• Soil characteristics and systems geometry
• Electrical current flow analysis
• Step and touch potentials determination
• Design and installation aspects
• Measurements of soil resistivity, resistance grounding and voltages
• Case studies: substations and smaller stations based on current standards and applicable legislation

Date: 19-21 May 2020.
Location: Madrid, Spain.
Price: 1,480 EUR

Protection for electric power systems

Objectives
Identify the main protection devices and systems used in generation, transmission and distribution.

Audience
Engineers without experience in the field of electrical protection, as well as those who are interested in the theoretical aspects of their operation.

Course topics
• Fault calculation
• Devices associated with protection systems
• Basic concepts regarding protection relays
• Protection for lines
• Protection for generators
• Protection for static machines
• Common protection for systems

Date: 21-24 April 2020.
Location: Madrid, Spain.
Price: 1,480 EUR

Overvoltage and insulation coordination

Objectives
Understand how to ensure the insulation coordination of electrical systems. Learn how to select surge arresters, line insulation levels, shield wires, earthing and related items.

Audience
Engineers and technicians with an electrical background.

Course topics
• Insulation coordination
• Temporary overvoltages (TOV)
• Fast front lightning overvoltages
• Slow front overvoltages
• Insulation levels selection and coordination
• Protection equipment. Surge arresters
• Shielding
• Substation case study

Date: 6-7 October 2020.
Location: Madrid, Spain.
Price: 1,480 EUR

Date: 22-23 June 2020.
Location: Stone, United Kingdom.
Price: 1,250 EUR
Systems Engineering

Protection coordination and arc flash hazard analysis

Objectives
Understand the concept of Power System protections and grading studies.
Understand arc flash hazard concept and analysis.

Audience
Personnel from electric utilities, power generation, transmission companies and industries and consultants responsible for system design, planning and engineering of power system.

Course topics
• Power system protection principles
• Relay co-ordination and grading between overcurrent and protection devices
• Directional overcurrent relays
• Unit protection
• Primary and backup relays and their grading
• Arc flash hazard concepts
• Arc flash hazard analysis
• Power system study tools
• IEEE 242, NFPA standards
• Case studies

Date: 14-15 May 2020.
Location: Stone, UK.
Price: 1,250 EUR

Substation engineering

Objectives
Understand various substation basics and switching configurations.
Understand different types of busbar configurations and layout engineering issues.
Understand the various substation equipment and accessories.

Audience
Electrical engineers, design, EPC, testing and commissioning personnel, consultants and engineers from generation companies, industries having IPPs and CPPs, utilities, industries and process plants, academia, students of electrical/power system.

Course topics
• Switchyard basics, various switching configurations
• Basics of protection philosophy for different bus configurations
• Layout engineering (basic considerations)
• Overview of substation design calculations
• Statutory obligations and safety aspects in substations
• Equipment and accessories

Date: 18 May & 14 September 2020.
Location: Vadodara, India.
Price: 600 USD

Power system earthing

Objectives
Gain knowledge necessary to design and manage the earthing systems for utilities and industries.
Appreciate the complex problems of conductive and inductive interrelationships between substation and powerline earthing.
Appreciate the techniques for solving problems found in earthing system design using computer based techniques.

Audience
Asset managers, project managers, maintenance managers, electrical engineers and other technical staff responsible for power system or other assets that rely on earthing systems for their safe and correct operation. Understand the risk associated with earthing and possible mitigation options.

Course topics
• Basic concepts of earthing, electrical properties of soil and measurement
• Earth potential rise, step and touch potential concepts
• Fundamentals of overhead line earthing, cable earthing and equipment earthing
• Basics of lightning and surge protection
• Overview of earthing system design and case studies

Date: 19-20 May & 15-16 September 2020.
Location: Vadodara, India.
Price: 980 USD
Equipment Management & Safety

HV&MV Switchgear and power transformers

Objectives
Understand the use and application of circuit breakers, instrument transformers, disconnectors and surge arrestors and power transformers. Discover the critical elements when it comes to operation & maintenance of HV&MV switchgear and power transformers.

Audience
Professionals from power utilities, power generation, transmission companies, industries and consultants responsible for engineering, commissioning, operation and maintenance of substations.

Course topics
• HV/MV Circuit Breakers - 11kV to 400kV (SF6 & Vacuum)
  - Classroom module: Role of CB, operation and construction & SF6 properties, gas filling and handling
  - Field module: factory visit and demonstration
• Instrument transformers
  - Role of instrument transformers, Operating principles
  - Design Parameters
• Disconnectors
  - Need of disconnectors: components, operation and construction
  - Storage, transport and installation – commissioning
  - Maintenance & troubleshooting
• Surge arrestors
  - Need, definition, use, features, function
  - Protective characteristic, Classification of surge arresters, IEC energy classes
  - Design - polymer housed arresters, Silicone: hydrophobicity
  - Installation, Maintenance & troubleshooting
• Power transformers
  - Transformer selection & application. Accessories
  - OLTC – Design, types, selection, testing, operating principle and maintenance
  - Manufacturing & testing
  - Storage, Transport, Installation, operation
  - Maintenance and Diagnostics checks
  - Demonstration of - Core Assembly, Active Part Assembly – winding, drying, Final Assembly, Testing
  - Testing of power transformer/reactors at factory and site

Date: 17-21 February & 6-10 July & 2-6 November 2020.
Location: Vadodara, India.
Price: 2,750 USD
Equipment Management & Safety

Operation, maintenance and condition monitoring of switchyard equipment

Objectives
Assess the condition of switchyard equipment. Minimize the cost of failure of peripheral equipment and unavailability of power due to forced shutdown. Optimize resources to plan and operate the electric systems reliably and with the maximum economic benefit.

Audience
Professionals from power utilities, power generation, transmission companies, industries and consultants responsible for engineering, commissioning, operation and maintenance of substations.

Course topics
- Circuit Breakers (HV & MV)
  - Operation and construction
  - SF6 gas filling & handling
  - Inside the Breaker - Hands on practice, demo
  - Operation, maintenance & troubleshooting
- Instrument Transformers
  - Operating principles and construction
  - Operation, maintenance, troubleshooting & testing
- Power Transformer
  - Design aspects and insulation
  - Transformer accessories (breather, bushings, PRV, Buchholz, MOLG core and part assembly)
  - Operation, maintenance, troubleshooting & testing.
- Case studies
- Condition Monitoring
  - Degradation of insulation
  - Sweep frequency response – fundamentals, concept, analysis & measurement
  - Interpretation of results
  - Demonstration of various diagnosis tests

Date: 10-14 February & 6-10 April & 17-21 August 2020.
Location: Vadodara, India.
Price: 2,750 USD

Transformer maintenance and diagnosis

Objectives
Become familiar with the transformers’ life management based on condition analysis, risk assessment and overall planning. Discover the key diagnostic method and techniques of preventive and corrective maintenance.

Audience
Engineers and technicians interested in advanced management of transformer life.

Course topics
- Types of transformers and configurations
  - Main components and configurations
  - Accessories and protection components
  - Maintenance techniques
  - Preventive
  - Predictive
  - Corrective
  - Advanced diagnostic testing
  - Visit to the transformer repair facilities

Date: 10-12 March 2020.
Location: Bilbao, Spain.
Price: 1,620 EUR
Equipment Management & Safety

**Power transformers**

**Objectives**
Delve into the basics of transformer and reactors design, construction, accessories, auxiliary & monitoring devices. Identify the main parts of the operation and maintenance processes linked to power transformers.

**Audience**
Professionals from power utilities, power generation, transmission companies, industries and consultants responsible for engineering, commissioning, operation and maintenance of substations.

**Course topics**
- Basic electrical concepts regarding transformers and reactors
- Working principles, core, winding, losses etc
- Introduction to transformers & reactors
- On Load Tap Changer
- Inspection and test procedures commonly performed on transformers
- Transformer oil, dissolved gas analysis
- Interpreting oil test results and maintenance options
- Monitoring and digitalization of transformer health
- Diagnostic testing and life extension
- Manufacturing & assembling process
- Core, winding
- Safety: standards and regulations, safe work procedures, and usage of personal protective equipment
- Case studies

**Date:** 16-20 March & 13-17 July 2020.
**Location:** Vadodara, India.
**Price:** 2,750 USD

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**Electrical safety**

**Objectives**
Standardize the approach to safe ways of working in an electrical environment.
Gain an understanding of and convey safe work practices.
Highlight the importance of adopting standard tools and equipment.

**Audience**
Engineers in the electricity field having to deal with on-site daily work and safety.

**Course topics**
- Course objectives
- The electrical safety rules
- Electrical incidents and common themes and a way forward
- PICW definitions and defining electrical competency
- PICW – assignment of roles and responsibilities
- Planning and preparation – risk assessment/jha/method statement
- 7 steps to safety
- Voltage detectors – ratings, calibrations, etc.
- LOTO, group LOTO, earthing/grounding
- Standardized permit to work (PTW) and PTW process
- Hazards of electricity (shock, arc flash, arc blast)
- Insulated PPE and Arc-Flash Workwear/PPE
- New arc flash clothing and PPE matrix – application of the matrix
- Core, winding
- Safety: standards and regulations, safe work procedures, and usage of personal protective equipment
- Case studies

**Date:** 2-3 April & 1-2 June & 5-6 October 2020.
**Location:** Vadodara, India.
**Price:** 980 USD

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**Site Management**

**Objectives**
Gain a greater and clear understanding of the entire site management process.
Enhance the ability to optimize site management practices.
Increase the expertise in the management of materials, equipment, storage, cost control and human resources.
Increase the knowledge of quality control.

**Audience**
Professionals in the energy sector such as project managers, site managers, quality engineers and site engineers.

**Course topics**
- Site selection criteria
- Introduction to site management
- Site management basic
- Site equipment planning
- Materials management
- Manpower planning
- Contractual & legal responsibilities
- Site planning, control & monitoring
- Managing the quality of site work
- Managing safety, security & risk
- Site management procedures
- Site testing
- Factory visits
- Site closeout

**Date:** 20-22 April & 28-30 September 2020.
**Location:** Vadodara, India.
**Price:** 1,650 USD
System Solutions

Introduction to voltage control and reactive power. FACTS solutions

Objectives
Understand the fundamentals of voltage and reactive power network problems. Discover the alternatives, technical and economical advantages that FACTS systems can provide.

Audience
Professionals dealing with reactive power problems who are interested in the technological solutions and their applications.

Course topics
- Voltage and reactive power control
  - Analysis of grid problems
  - Consumption and generation of reactive power
  - Solutions for reactive power and voltage control
- FACTS systems
  - Dynamic shunt compensation
  - Applications of FACTS devices: T&D grids, renewables, industry, railway
  - Configuration and components of a FACTS installation
  - Control and protection
- Comparison of STATCOM and SVC
- Economics of FACTS
- A FACTS project: from the feasibility study to commissioning

Date: 24-26 March 2020.
Location: Madrid, Spain.
Price: 1,380 EUR

Grid integration of HVDC light, offshore HVDC and FACTS devices

Objectives
Understand the role of HVDC in today’s grids. Discover the functionalities of Voltage Source Converters (VSC) in FACTS and HVDC systems.

Audience
Engineers with experience as grid planners and interest in better understanding the role of HVDC and FACTS devices.

Course topics
- HVDC introduction (history and background)
- FACTS devices and characteristics
- VSC theory
- VSC harmonics
- VSC controls
- Network Integration (steady-state analysis)
- Control modelling for studies
- Case studies for dynamic and harmonic analysis

Date: 24-25 March 2020.
Location: Mannheim, Germany.
Price: 1,980 EUR

Date: 10-12 June 2020.
Location: Stone, United Kingdom.
Price: 1,875 EUR
Planning Studies

Power system studies: planning and analysis

Objectives
Understand the modelling of the power system and concepts of power flow studies. Understand short-circuit studies, stability studies and protection principles.

Audience
Personnel from electric utilities, power generation, transmission companies and industries and consultants responsible for the system design, planning and engineering of power system.

Course topics
• Power system studies-Introduction
• Modelling of power system components and networks for various studies
• Load flow studies-voltage profile calculations and influencing factors, modelling and case studies
• Contingency analysis and optimal power flow
• Short-circuit studies-Z bus matrix and symmetrical components, balanced and unbalanced faults
• Transient stability analysis and voltage stability analysis
• Basics of power system protection and devices
• Integration of wind farms in utilities
• IEEE and IEC standards
• Power system study tools
• Case studies

Date: 21-24 April 2020.
Location: Stone, UK.
Price: 2,500 EUR
Introduction to NEPLAN: a power systems software

Objectives
Gain a comprehensive vision of the main functionalities of the software.
Master basic actions in NEPLAN: represent grids, work with diagrams, graphic layers and efficiently use the short-circuit and power flow modules.

Audience
Engineers involved in the study and design of power grids, beginners in this type of software.

Course topics
• Basics of the user graphic interface
  • Create and edit NEPLAN libraries
  • Symbol editor
  • Data export
  • Graphic and grid layers
• Load flow analysis
  • Theoretical basics for load flow calculations
  • Power system element modelling
  • Reference value adjustments
  • Load balance
• Short-circuit analysis: single-phase, two-phase, three-phase
• Single-line diagrams and tables
• Case studies

Date: 8-10 September 2020.
Location: Madrid, Spain.
Price: 1,380 EUR
Specialty Issues

A primer for subsynchronous oscillations (SSR, SSTI, SSCI)

Objectives
Gain a general understanding of the various types of subsynchronous oscillation (SSO) phenomena and their causes.
Gain an overview of the studies required to identify the potential risks of SSO.
Review possible mitigation and protection measures for SSO.

Audience
Individuals who work for developers, electric utilities and transmission system operators who need a high-level understanding of the risks associated with subsynchronous oscillations including the potential impacts to equipment, plant design and points-of-interconnection.

Course topics
• History of SSO
• Overview of SSO phenomena and their causes
  - Induction Generator Effect and Subsynchronous Control Interaction (SSCI)
  - Torsional interaction due to series capacitors and active devices such as HVDC stations, SVCs or STATCOMs
  - Torque amplifications
• Impacts of POI selection
• SSO studies
• Potential mitigation and protection options

Date: 9th May 2020
Location: Raleigh, North Carolina, USA.
Price: 950 USD

Subsynchronous oscillations: phenomena, studies and mitigation

Objectives
Understand of the various types of subsynchronous oscillation (SSO) phenomena.
Understand the role of electrical machines and the power grid in SSO.
Understand the studies required to identify the potential risks of SSO and how to interpret the results. Review potential mitigation and protection measures for SSO.

Audience
Individuals who work for developers, electric utilities and transmission system operators who need a more complete understanding of the risks of subsynchronous oscillations and the potential impacts to equipment, plant design and points-of-interconnection.

Course topics
• An Overview of SSO and its history
• The underlying concepts of SSO phenomena
• Electrical machines and characteristics associated with SSO
• Mechanical aspects of machines associated with SSO
• The electrical grid’s contribution to SSO
• In depth discussion of SSO phenomena
• Mitigation and protection for SSO
• SSO studies and modelling aspects

Date: 15-17 September 2020
Location: Raleigh, North Carolina, USA.
Price: 2,100 USD
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